TOLL FEASIBILITY STUDY

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and

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1 EXECUTIVE SUMMARY

1.1 Introduction

The Hampton Roads region has identified transportation infrastructure projects that hold promise to address future mobility issues and alleviate anticipated congestion:

- Hampton Roads Third Crossing
- Southeastern Parkway & Greenbelt, Dominion Boulevard
- US 460 Alternate
- Midtown Tunnel Expansion
- Martin Luther King Freeway Extension.

Prior to this study, there were several unsuccessful efforts to fund these transportation projects; beginning with the 1999 Regional Transportation Priority Setting completed as a part of the 2021 Regional Transportation Plan development process. This plan recommended funding the construction of these projects through the use of user tolls. Toll revenues were to be supplemented by a regional gas tax. The 2002 Regional Transportation Referendum proposed to build these projects, using a general sales tax to fund project construction. The referendum was not successful.

The 2026 Regional Transportation Plan, released in August 2003, contains some of these projects. The Plan's $30+ billion in candidate transportation projects has an anticipated funding deficit of over $20 billion. With the Virginia Department of Transportation (VDOT) finding "that the reliance on a regional gas tax is not a reasonably foreseeable source of revenue for the current [2026] plan update", and the Federal Highway Administration (FHWA) allowing user tolls for substantial reconstruction of bridge/tunnel facilities; this study was conceived to evaluate the feasibility of using toll-based financing as a means to fully or partially fund these transportation projects.[1]

1.2 Report Context

This document summarizes the feasibility evaluation process and provides a comprehensive discussion of many topics introduced to the Metropolitan Planning Organization during its September, October, and November 2004 meetings. The feasibility evaluation process includes:

- Estimation of travel demand, under tolled conditions
- Projection of toll revenues
- Projection of project costs

1 Correspondence supporting statements to the Hampton Roads Planning District Commission (HRPDC) by VDOT and FHWA are in Technical Appendices "A" and "B" respectively.

- Evaluation of project funding deficit or surplus
- Evaluation of transportation system Impacts

In this study, project funding evaluation uses the maximum toll revenue attainable.

1.3 Project Feasibility Evaluation

This study investigated the feasibility of using toll-based financing as a means to fully fund several transportation improvement projects in the Hampton Roads region. These projects were evaluated as "stand-alone" (individual) and in combination with toll revenues from other roadways. Projects were also evaluated with respect to the impact of tolls on the magnitude of travel demand, and the change in regional travel patterns and roadway "level-of-service" (LOS).

The feasibility of toll implementation for the purposes of funding infrastructure improvements constitutes two (2) primary components:

1. Portion of debt service[2] covered by toll revenues (cash flow analysis)
2. Impact on travel demand

This study provides a comprehensive financial feasibility and travel demand impact analysis for each improvement project. Table 1.3-1 describes the projects.

This study uses a modified version of the Hampton Roads Regional Travel Model as the means to estimate travel demand for the projects under tolled conditions. These travel demand estimates are the basis for generating a schedule of revenues associated with the project over the 30-year study or re-payment period. Projects are tolled on a "per mile" basis and do not consider the physical configuration of a toll collection mechanism, assuming "open road" tolling technology.

2 Addressing project expenses, including, but not limited to, engineering, right-of-way acquisition, construction, financing, toll collection, and maintenance

Table 1.3-1 Project Descriptions

Project	Improvement	Distance	Tolled Distance
Hampton Roads Crossing	I-564, west of I-64: widen to 8 lanes + 2 lanes (transit)	2.7 mi.	0 mi.
	I-564 to MMMBT (E/W Connector) : new 4-lane highway + 2 lanes (transit)	6.4 mi.	6.4 mi.
	I-664, E/W Conn. to 28th St., 2nd MMMBT tube: 8 lanes + 2 lanes (transit)	2.4 mi.	2.4 mi.
	Craney Island Connector: new 4-lane highway	5.6 mi.	5.6 mi.
	I-664, 28th St. to I-664/I-64 Interchange: widen to 8 lanes	4.7 mi.	4.7 mi.
	I-664, I-64/I-264 Interchange to E/W Conn.: widen to 6 lanes	13.3 mi.	13.3 mi.
Midtown Tunnel & MLK Freeway Extension	Midtown Tunnel, Pinners Point Connector to Brambleton Avenue: new 2-lane tunnel	1.0 mi.	1.0 mi.
	MLK Freeway, I-264 to High Street	0.6 mi.	0.6 mi.
Route 460	I-664 to Suffolk Bypass: widen to 4 lanes	5.7 mi.	0 mi.
	Suffolk Bypass to I-295: new 6-lane highway	47 mi.	47 mi.
Southeastern Parkway & Green Belt	I-264 to Oak Grove Connector: new 4-lane highway	24 mi.	24 mi.
	Oak Grove Connector	1.9 mi.	1.9 mi.
	Dominion Boulevard, George Washington Hwy. To Oak Grove Connector	6.6 mi.	2.7 mi.

1.3.1 Financial Feasibility

"Stand-Alone" Projects

This analysis produced, for each individual project, a revenue-optimized toll rate, a travel demand estimate, and an associated revenue schedule. All project toll revenues start accruing after construction of the facility is complete. Section 3.2.1 of this report lists toll values for the projects.

Table 1.3-2 shows the degree to which individual project costs can be covered using toll-based financing, including some committed State and federal funds for selected projects (NHS, RSTP, and Primary) shown under "additional funding". Toll revenues from the project leverage funds shown under "total bond/loan funds". The "funding deficit" column shows a significant funding deficit for each project, indicating that other funding sources or a re-scheduling of funding is necessary to cover project costs if they are to be financed using project tolls.

In the stand-alone analysis, this study assumes that revenue from tolls does not start until the project is completely constructed and opened; creating a substantial delay between the beginning of scheduled expenditures (Construction Start Date) and the toll revenue start date. In the case of the Hampton Roads Third Crossing, the delay is eleven (11) years. During this time financing costs continue to rise with no revenue to offset. With project toll revenues as the only leverage for bonds and loans, project financing is costly and inefficient for start-up toll facilities.

Table 1.3-2 "Stand-Alone" Project Capital Sources & Costs Summary

Project	P/D & E (1)	Net Total Cost (2)	Additional Funding (4)	Total Bond / Loan Funds	Funding Deficit	Const. Start Date	Total Revenue Start Date
HRX, Segment I	53,850,000	1,833,348,300	-	82,670,500	1,750,677,800	2005	2008
HRX	81,000,000	4,152,372,000	-	336,804,100	3,815,567,900	2006	2017
Midtown & MLK	12,630,000	548,827,600	-	83,915,300	464,912,300	2009	2015
Route 460	26,820,000	1,468,264,000	321,000,000	454,236,600	902,375,200	2010	2018
SP&G (3), I-264 to I-64	14,670,000	931,532,800	420,000,000	598,046,400	337,797,000	2010	2017
SP&G (3), Dominion Boulevard	3,270,000	185,180,200	100,000,000			2010	2017

(1) Preliminary design and engineering costs are estimated to be 3% of non-inflated project cost.
(2) Preliminary design and engineering have been subtracted out
(3) SP&G bond/loan amount, and funding deficit shown in aggregate.
(4) NHS, RSTP, and Primary funds. Only part of these funds is scheduled in the construction period; the remainder used to increase bond capacity.
Note: all values are US dollars at year of accrual or expenditure

Toll Financed Projects Using Unimproved Roadway Toll Revenue

Based upon the individual facility results, this Study examines three project scenarios that feature tolling of existing unimproved roadways parallel to the projects under study. Table 1.3-3, below, lists the features of each project scenario.

The introduction of toll revenues from existing roadways at the beginning of the project expenditure schedule (especially where a verifiable traffic history is available) can dramatically increase financial feasibility by:

- Reducing construction cost
- Increasing bonding and loan capacity
- Reducing accrual of interest

Table 1.3-3 Project Scenarios

Features	Project Scenario #1	Project Scenario #2	Project Scenario #3
Projects	• HRX	• Improved HRBT (1)	• Midtown & MLK
Existing/Unimproved, Tolled Roadways	• MMMBT • JRB • HRBT	• MMMBT • JRB • HRBT	• Downtown Tunnel

MMMBT – Monitor Merrimac Bridge Tunnel
JRB – James River Bridge
HRBT – Hampton Roads Bridge Tunnel
(1) Hampton Roads Crossing Study, Alternative #1

Toll values for each project scenario were developed to satisfy three objectives: (1) maximize toll revenues; (2) ensure that roadway patrons are not "tolled-off"[3] of roadways; and (3) employ "value-priced" variable tolls[4]. This study examined value-price tolling for two time periods: peak and off-peak. Section 3.2.2 toll values for the project scenarios in detail. Table 1.3-4, below, shows the degree to which individual project costs can be covered using project tolls and funding provided by unimproved roadways.

Scenario #1 still has a significant funding deficit with the introduction of existing roadway toll revenues. Scenarios #2 and #3 are financially feasible. Scenario #3, in fact, has significant excess financing capacity, which means that it could be feasible at less than the stated toll rates. Only 37% of estimated toll revenue for Scenario #3 is required to cover costs.

3 Toll value is high enough that the majority of roadway capacity is unused due to travelers avoiding the roadway.

4 Value-priced tolls are tolls that change depending on the level of congestion, such that higher tolls are charged during more congested periods

Table 1.3-4 Project Scenario Capital Sources & Cost Summary

	Net Total Cost (1)	Additional Funding (3)	P/D & E (2)	Total Bond / Loan Funds	Funding Deficit	Const. Start Date	Toll Revenue Start Date
Scenario #1 HRX	4,152,400,000	193,500,000	81,000,000	2,805,000,000	1,153,900,000	2006	2006
Scenario #2 HRBT	1,845,500,000	116,300,000	36,000,000	1,729,200,000	-	2006	2006
Scenario #3 Midtown & MLK	548,800,000	251,100,000	12,600,000	297,700,000	-	2009	2009

(1) Preliminary design and engineering have been subtracted out
(2) Preliminary design and engineering costs are estimated to be 3% of non-inflated project cost.
(3) Toll revenues from unimproved roadways scheduled to offset construction costs (the remainder of toll revenue used to increase bond capacity).
Note: all values are US dollars at year of accrual or expenditure

Financial Risk Assessment

There are a number of risks associated with toll road development. The financing plans for these projects are based upon estimates of costs and revenues. The exact values of these costs and revenues are not truly known and may well change over the lifetime of the project: the construction schedule may slip due to delays caused by environmental or other issues; the construction costs could increase due to poor estimation or unforeseen complications; or the traffic and revenue may not reach forecasted targets due to improvements of competing facilities or changes in travel behavior. Understanding these risks and their financial implications can help make a better-informed decision on whether to proceed with the project.

Table 1.3-5 shows the probable variability in funding or financial feasibility based on a risk analysis performed for this study. A more detailed discussion of results, analysis methods, and assumptions can be found in Section 3.2.3 and in Appendix “F”. Since the Project Scenario #3 is very well funded, an analysis of financial risk was not necessary.

Table 1.3-5 Funding Deficit Uncertainty

Project	Funding Deficit	Probable Deficit Range	Percent Deviation (2)
HRX, Segment I	1,750,677,800	1,668,286,400 to 1,841,708,300	-5% to +5%
HRX	3,815,567,900	3,429,170,500 to 3,971,288,500	-10% to +4%
Midtown & MLK	464,912,300	399,227,800 to 469,173,347	-14% to +1%
Route 460	902,375,200	691,823,400 to 972,789,400	-23% to +8%
Southeastern Parkway & Greenbelt	337,797,000	146,185,800 to 406,486,200	-57% to +20%
Project Scenario #1	1,153,900,000	42,486,700 to 1,823,747,000	-96% to 59%
Project Scenario #2 (1)	(144,954,200)	(903,434,800) to 320,068,000	-523% to 320%

(1) Actual funding surplus reported here

(2) Deviation based on probable deficit range as compared to the calculated funding deficit

Note: Values in table represent deficits; therefore a funding surplus is represented by a negative value. All values are US dollars at year of accrual or expenditure

Note that the reported "stand-alone" project funding deficits are all in the higher portion of the probable deficit range – indicating that assumptions used in this study associated with project financing and operation are conservative. Table 1.3-5 also indicates that even when taking uncertainty into account, all "stand-alone" projects still experience a funding deficit.

There is considerably more uncertainty associated with funding deficits for the project scenarios. This is clearly illustrated when comparing the Hampton Roads Crossing project (HRX) with Project Scenario #1. Construction costs are the same for both. But reliance on toll revenue from unimproved roadways throughout the construction schedule introduces more uncertainty into its financial feasibility.

1.3.2 Impact of Tolls on Travel Demand

Feasibility of toll implementation for the purposes of funding infrastructure improvements also constitutes an examination of the effect of tolls on travel demand. It is important to gauge the utilization of the tolled roadways – how much of the roadway capacity is being used. While roadway improvements are designed to alleviate

congestion; if tolls are too high, travel demand for these roadways will be relatively low leaving a significant amount of excess capacity. The improvements the tolls are financing will therefore not sufficiently benefit the traveling public. Tolls may also cause travelers to deviate from tolled routes creating congestion problems on roadways that are part of competing routes. These effects can impact existing transportation plans and planning activities associated with other projects.

Specifically, this study intended to examine changes in roadway level-of-service and travel patterns associated with tolling of projects subject to financial analysis in the previous section. However, it is important to remember that this study analyzed project financial feasibility under conditions that maximize revenue and in many instances this assumption resulted in toll values that significantly reduced travel demand on project roadways. The travel impact analysis in this study can provide, however, useful qualitative information regarding the impact of the tolls and projects on travel demand. Travel demand impacts are discussed more extensively in Chapter 4.

2 PROJECT DEMAND AND REVENUE ESTIMATION

2.1 Demand Estimation

The Hampton Roads regional travel demand model is used to develop traffic and revenue projections for the candidate toll facilities under consideration in this study. Appendix "C" contains details of the travel demand model implementation for this study, and is particularly important since many toll road revenue forecasts have been plagued by substantial forecasting error associated with travel demand. On average, projects miss their forecasted revenues by 35-40% in the third year.[5] Projects that met projections offered at least 5 minutes of time-savings, served a higher income level, and were forecasted to grow at less than 5% annually. Conversely, projects that over forecast traffic are plagued by expansion of competing freeways, tolls too high relative to the income base (corresponding to overstatement of the value-of-time), overestimation of land use growth, and improper handling of usage patterns (peak periods, directionality, vehicle classes, etc.).

While a detailed investment-grade traffic and revenue study is beyond the scope of this project, there is need to apply the available tool, the regional transportation model, in the most appropriate manner to avoid the mistakes of failed projects noted above. The traffic and revenue forecasts will serve as one component of the initial assessment of the feasibility of these toll roads. Although this assessment will not be used to secure project financing, it is intended to develop a solid foundation for further, more detailed analysis while initiating consideration of the candidate toll facilities and their relative merits.

2.1.1 Project Demand Estimates

Financial feasibility analysis for each stand-alone project and project combination requires a toll revenue schedule for a 30-year period. Calculation of the revenue schedule requires a travel demand estimate on all tolled roadways for the years 2017 and 2026.

"No-project" and stand-alone project network models were created by modifying the Year 2026 Regional Transportation Plan network. The no-project network was defined as the Plan network minus the Hampton Roads Crossing (Segment I), Route 460, and the Southeastern Parkway and Greenbelt. Projects evaluated by this Study were then coded into the Year 2026 No-Project network model using planning data available for each project, ensuring consistency with on-going VDOT studies. This information included facility description, alignment and capacity information. Demand estimates generated reflect all land use assumptions associated with the Year 2026 Regional Transportation Plan.[6]

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5 Muller, Robert H. "Tollroad Feasibility Studies: An Historical Perspective." Presented at the 2001 Transportation Research Board Annual Meeting, 2001.

6 Air quality modeling for the 2026 Plan included a year 2017 scenario.

The travel model produced Year 2026 travel demand estimates for the projects using an array of toll rates and determined those rates (T_{mar}) that maximize revenue for each of the five (5) stand-alone projects and three (3) project scenarios. The optimal toll or T_{mar} was derived by creating demand vs. toll and revenue vs. toll curves, identifying the toll value that yields the greatest revenue. Year 2017 travel demand was then estimated using the optimal toll value.

2.2 Revenue Estimation

Once the daily revenue forecasts are produced by the travel model revenue maximizing toll values, the next step is to convert the travel demand model output into a revenue schedule for the financial model. The conversion from travel demand model outputs to a revenue schedule is dependent on a number of elements including the revenue schedule start year, non-model year revenues, the inflation rate, annualization factor, and a ramp-up factor.

2.2.1 Revenue Schedule

Start Year

For the stand-alone projects, toll revenues are not collected until after construction has been completed and the roadway is opened to traffic. Thus, the opening year is the first year following the end of the construction schedule. Construction schedules provided by HRPDC identify the opening year for each project and assume year 1 of the project schedule is 2004. Construction schedule assumptions are shown in Table 2.2-1 and are financially "unconstrained".

Table 2.2-1 "Stand-Alone" Project Schedule Assumptions

Project	Construction Start Year	Revenue Start Year
Hampton Roads Third Crossing - Segment 1*	2005	2008
Hampton Roads Third Crossing	2006	2017
Midtown Tunnel & MLK	2009	2015.5
Route 460	2010.5	2018
SP&G	2010	2017.5

* Schedule based on constrained and unconstrained schedules for staging of the full Hampton Roads crossing

Some of the projects complete construction mid-year. This is accounted for by beginning the revenue in the 2nd half of the same year. Thus, the 30-year revenue schedule includes 31 calendar years with the first and last only including half year revenues.

Creation of Full Schedule

The regional travel demand model has data available to produce Year 2000, 2017 and 2026 demand estimates and thus revenue. For the stand-alone projects, the model years 2017 and 2026 serve as reference points to calculate yearly revenue growth using linear interpolation. Combination projects us the same method, except that an additional reference point for Year 2000 provides a way to estimate toll revenues collected on the unimproved facilities during project construction. Technical Appendix "D" provides detail on calculations used to create the schedules.

Inflation Rate

All monetary elements (tolls, vehicle operating cost, and value of time) of the travel demand model use year 2000 dollars, but the financial model needs revenues in the year of accrual. Year 2000 dollars inflated at a rate of 3.89% yields year of accrual dollars. This is the same inflation rate used for the cost estimate schedule and agreed upon for the referendum by HRPDC, Solomon Smith Barney, and the State of Virginia.

Toll Increases

Since the revenue schedules are based on Year 2017 and Year 2026 (and sometimes Year 2000) forecasts, forecasting the travel demand and revenue levels associated with future toll levels would be an imprecise method to identify future revenue levels. Rather, this study assumes that tolls increase with inflation. This allows the conversion of revenues for each year from year 2000 dollars to each schedule year's current dollars by applying the estimated inflation rate.

Conversion from Daily Revenue to Annual Revenue

The travel demand model forecasts daily travel demand and revenue, but the financial analysis requires annual toll revenue. An annualization factor converts daily to annual revenue. This factor must consider the expected level of weekend traffic. Two groups of projects, according to their level of weekend traffic, use separate factors. Technical Appendix "D" contains details of annualization factor derivation.

2.2.2 Revenue Ramp-up

Toll roads experience a "ramp-up" period of traffic and revenue. Introduction of a ramp-up period into the revenue schedule accounts for this behavior. J.P. Morgan's review of start-up toll roads provides a basis for accounting for a "ramp-up" period. The publication groups toll facilities based upon shared features and compares actual traffic and revenue to forecasted values. The project that are the focus of this study best

match definitions of Group 3: Developed Corridors, Parallels of Existing Roads and/or Faulty Economic Forecasts, and Group 4: Less Developed Areas.

The report provides two data sets of particular interest: 1) actual traffic and revenue as a percentage of each year's forecasted traffic and revenue, and 2) forecasted traffic and revenue growth rate for first four years. These datasets were combined to calculate a new data set of each year's actual traffic and revenue as a percentage of the opening year's forecasted traffic and revenue. Actual growth appears steady after 2 years, for both of the JP Morgan groups.

Revenue ramp-up is accounted for as follows:

- Determine the average, mean and standard deviation of observed 2-year growth of each group.
- Limit the maximum growth rate of individual facility observations at one standard deviation from the mean, and then recalculate the mean. Since the JP Morgan report has a limited number of observations in each group, this allows outlying observations to be included in such a way that their values do not dominate the mean.
- Determine the 1-year growth rate using the same procedure.
- Apply these ramp-up factors to determine the revenues for the first 2 years of project opening. Use the 2-year actual growth rate to discount project Year 3 revenue to calculate the opening year revenue, and then use the 1-year growth rate to determine Year 2 revenue.

The Hampton Roads Third Crossing projects (both full and Segment I) present a different challenge. Unlike the other projects, there will likely be a "ramp-down" period for this project as trip patterns adjust to the new toll crossing. These projects and their associated tolls will change the distribution of trips with more people electing to live and work on the same side of the harbor. However, this new steady-state condition will not occur instantaneously with the opening of the facility. Experience with transit projects is that there is a 5-year period during which development occurs around the new transit facility and people adjust their trip-ends to utilize the new service. Since these projects will not promote the same level of new development, the trip-end adjustment should be a shorter period. This study assumes a 3-year ramp-down period that closely corresponds to the 3.4 to 3.8 year range of average job tenure reported by the Bureau of Labor Statistics. Table 2.2-2, below, summarizes revenue schedule adjustments.

Table 2.2-2 Project Revenue Schedule Adjustments

Project	JP Morgan Group	Revenue Schedule Adjustments		
		Year 1	Year 2	Year 3
Hampton Roads Third Crossing - Segment 1	N/A	+ 30%	+ 20%	+10%
Hampton Roads Third Crossing	N/A	+ 30%	+ 20%	+10%
Midtown Tunnel & MLK	3	82% of Year 3 forecast	94% of Year 3 forecast	No Adjustment
Route 460	4	54% of Year 3 forecast	85% of Year 3 forecast	No Adjustment
Southeastern Parkway & Greenbelt	4	54% of Year 3 forecast	85% of Year 3 forecast	No Adjustment

3 FINANCIAL FEASIBILITY EVALUATION

3.1 Financial Feasibility Model

This study uses a proprietary toll facility financing model. The model incorporates data describing project costs, construction schedules and scheduled revenue. The toll facility financing model used in this study is the industry standard for municipal bond structuring, to structure bond issuances. Appendix "E" contains a detailed discussion of all financing assumptions and financial model structure.

3.1.1 Project Capital Costs

Capital costs were developed using an unconstrained 14-year cost expenditure schedule provided by HRPDC. The expenditure schedule was modified to reflect anticipated construction timing and duration. HRPDC also provided total project costs. This Study assumes that preliminary design and engineering (P/D&E) costs are 3% of the total uninflated project cost, and will be funded by the State. For example, if project "A" has a total capital cost of $100 million (2002 dollars), then preliminary design and engineering costs are calculated to be $3 million – yielding a total adjusted cost of $97 million. A 3.89% annual inflation factor was applied to each adjusted cost to yield inflated or year-of-expenditure (YOE) project costs. Table 3.1-2 shows information used to calculate year-of-expenditure (YOE) costs for each project.

Table 3.1-1 Capital Costs & Construction Schedule

Project	Cost Year $	P/D&E (1)	Project Costs (2)	Construction Start Date	Years to Complete	YOE Net Total Cost
HRX, Segment I	2005	53,850,000	1,795,000,000	2005	3	1,833,348,300
HRX	1999	81,000,000	2,700,000,000	2006	11	4,152,372,000
Midtown & MLK	2004	12,630,000	421,000,000	2009	6.5	548,827,600
Route 460	2000	26,820,000	894,000,000	2010.5	7.5	1,468,264,000
SP&G, I-264 to I-64	1996	14,670,000	489,000,000	2010	7.5	931,532,800
SP&G, Dominion Boulevard	1999	3,270,000	109,000,000	2010	7.5	185,180,200

(1) Preliminary design & engineering costs (funded by the State) are estimated to be 3% of non-inflated project costs and have been subtracted out of year of expenditure (YOE) net total cost

(2) Does not include operation & maintenance or financing costs – only capital costs

3.1.2 Additional Funding Sources

State and Federal

Route 460 and the Southeastern Parkway and Greenbelt projects secured additional funding that can be used to offset construction costs. The Route 460 Project secured $321 million in NHS and Primary funding. In the feasibility analysis, these funds were assigned equally to a 23-year period beginning in 2010 – when Route 460 construction begins. The Southeastern Parkway and Greenbelt Project secured $520 million in NHS and RSTP funding.[7] Similarly, the additional funding was applied equally to a 23-year period beginning in 2010 – also when construction begins for this project. Because the revenues were distributed through 2032 and the construction periods end in 2017, the final fifteen years of revenues were added to toll revenues to increase the financing capacity in those years.

Revenues produced by tolling existing facilities

As described in Section 1.3.1, a second evaluation of the Hampton Roads Crossing included tolls from existing, parallel roadways in order to generate "upfront" toll revenues. Like the additional State and Federal funding described above, revenues from existing roadways offset capital costs and increase financing capacity. In addition, "upfront" toll revenues eliminate the need to capitalize interest. These revenues were applied in the following manner: 1) in years where there were no capital requirements revenues were deposited into a construction fund, 2) in years where construction requirements existed, and the revenues to date covered capital costs, deposited and current revenues were applied, 3) in years where capital requirements were greater than available existing revenues, revenues were instead applied to bond capacity and a toll revenue bond was issued; at which point all revenues in the future were used for debt service coverage.

Available State and Federal funding sources and "upfront" toll revenues cover capital costs, including right-of-way acquisition, through the beginning of construction. The availability of additional capital sources proves extremely beneficial to the financial feasibility of funding projects.

3.2 Analysis Results

It is important to emphasize that the financial feasibility analyses described herein are predicated upon all the assumptions previously described. In particular, the issuance of investment grade rated municipal bonds will depend upon the availability of a market-acceptable traffic & revenue forecasts for project and package as well as an acceptable consulting engineer's (construction) report. Any State or Federal permits would likely need to be approved. Any State or Federal funding, including any loan or credit enhancement programs, would need to be approved and documented. If applicable,

7 $100 million in RSTP funds will be applied to the Dominion Boulevard improvements

any PPTA and/or design-build construction contract would also need to be finalized and market-acceptable. All of these things in addition to a sound financial plan are required to create an investment grade bond financing.

3.2.1 Toll Financed "Stand-Alone" Projects

This analysis produced, for each individual project, a revenue-optimized toll rate, a travel demand estimate, and an associated revenue schedule. The revenue schedule start date is based on individual project construction schedules developed in conjunction with HRPDC and are financially "unconstrained". All project toll revenues start accruing after construction of the entire facility is complete. Listed below are the optimized tolls in Year 2004 US dollars:

- HRX – Segment I **$0.12/mi.**
- Hampton Roads Crossing (HRX) **$0.11/mi.**
- Midtown Tunnel and MLK Freeway Extension (Midtown & MLK)
    - Midtown Tunnel **$0.58/mi.**
    - MLK Freeway **$0.19/mi.**
- Route 460 **$0.11/mi.**
- Southeastern Parkway and Greenbelt (SP&G)
    - Dominion Boulevard from George Washington Hwy. To Oak Grove Connector **$0.83/mi.**
    - Oak Grove Connector **$0.56/mi.**
    - Oak Grove Connector to I-264 **$0.07/mi.**

Using all the construction and financing assumptions previously described, debt-financing structures were prepared for each individual project. The results are summarized in Tables 3.2-1 and 3.2-2. Table 3.2-1 shows revenue income and expenditures. Revenue to finance the projects comes from: 1) toll revenues, and 2) NHS, RSTP and Primary sources, if available, provided by Federal and State government. Operating & maintenance costs removed from incoming revenue yields net operating revenue. The amount of net operating revenue leverages federal loans (TIFIA) and bond issues at a debt service coverage ratio of 1.25, and thus has a direct bearing on the amount of bond/loan funds available to cover project capital costs.[8] The net operating revenue, less debt service expense leaves "excess proceeds" that are designated for various reserve funds in accordance with the Plan of Finance.[9]

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8 Appendix "E" - Credit Framework, under the section "Debt Service Coverage"

9 Appendix "E" – Plan of Finance and Financal Model Overview

Table 3.2-1 "Stand-Alone" Project Cash Flow

Project	Income		Expenditures		Excess Proceeds
	Gross Toll Revenue	NHS, RSTP, and Primary (1)	Operating & Maintenance Costs (2)	Debt Service (3)	
HRX, Segment I	400,028,400	0	120,008,500	223,735,500	56,284,400
HRX	1,973,350,100	0	592,005,000	1,104,541,300	276,803,800
Midtown & MLK	427,222,400	0	128,166,700	239,181,900	59,873,800
Route 460	2,053,546,400	209,347,800	616,063,900	1,317405,000	329,425,300
SP&G	2,771,217,100	339,130,400	831,365,100	1,823,136,800	455,845,600

(1) Portion used for operating revenue.
(2) Covers open road tolling infrastructure, toll administration, and maintenance of roadway (30% of gross toll revenues)
(3) Does not include capitalized interest (refer to discussion in Appendix "E")
Note: all values are US dollars at year of accrual or expenditure

Table 3.2-2 shows capital sources for each of the "stand-alone" projects; combining Net Total Project Costs (from Table 3.1-1) with funding available from Federal and State sources as well as bond/loan proceeds. Each project on a stand-alone basis has a significant funding deficit. This outcome is completely typical for large urban toll facility projects. With no upfront or tax generated revenue support, such toll projects can rarely pay for themselves. As an example, to leverage approximately $454 million in bond and loan funds to cover capital costs on the US 460 project; the project needs over two and a third billion dollars in funding to cover debt service costs of just over a billion dollars – still resulting in nearly a billion dollar funding deficit. Bonding for these projects is particularly difficult and costly, especially given the history of under-performing toll revenue-financed projects.

Table 3.2-2 "Stand-Alone" Project Capital Sources & Cost Summary

Project	Sources		Net Total Cost (2)	Funding Deficit	Const. Start Date	Toll Revenue Start Date
	NHS, RSTP, and Primary (1)	Total Bond / Loan Funds				
HRX, Segment I	-	82,670,500	1,833,348,300	1,750,677,800	2005	2008
HRX	-	336,804,100	4,152,372,000	3,815,567,900	2006	2017
Midtown & MLK	-	83,915,300	548,827,600	464,912,300	2009	2015
Route 460	111,652,200	454,236,600	1,468,264,000	902,375,200	2010	2018
SP&G	180,869,600	598,046,400	1,116713,000	337,797,000	2010	2017

(1) Portion scheduled in the construction period

(2) For Southeastern Parkway and Greenbelt, I-264 to I-64 and Dominion Boulevard costs are combined

Note: all values are US dollars at year of accrual or expenditure

3.2.2 Toll Financed Projects Using Unimproved Roadway Toll Revenue

Based upon "stand-alone" project results, this Study also examined financial feasibility of constructing toll projects while tolling unimproved, competing roadways. As discussed in Appendix "E", the introduction of "upfront" toll revenues, especially where a verifiable traffic history is available, can dramatically improve the financial feasibility of a project. Table 3.2-3 describes each of three project "scenarios".

Roadway improvements associated with two of the project scenarios[10] are based on "stand-alone" projects. Project Scenario #1, features the Hampton Roads Crossing Project and uses the construction schedule and cost assumptions for HRX shown in Table 3.1-1. Project Scenario #2, features the improved Hampton Roads Bridge-Tunnel[11] which was not included in the "stand-alone" projects previously examined. Scenario #2 assumes the same construction expenditure rate as HRX with project costs as cited the Hampton Roads Crossing Study. Project Scenario #3, the Midtown Tunnel/MLK Freeway Extension, uses its respective construction cost schedule as shown in Table 3.1-1.

10 Same as defined in the Hampton Roads Toll Feasibility Study presentation dated October 20, 2004

11 Hampton Roads Crossing Study, Alternative #1

Table 3.2-3 Project Scenarios

Features	Project Scenario #1	Project Scenario #2	Project Scenario #3
Projects	• HRX	• Improved HRBT (1)	• Midtown & MLK
Existing/Unimproved, Tolled Roadways	• MMMBT • JRB • HRBT	• MMMBT • JRB • HRBT	• Downtown Tunnel

MMMBT – Monitor Merrimac Bridge Tunnel
JRB – James River Bridge
HRBT – Hampton Roads Bridge Tunnel
(1) Hampton Roads Crossing Study, Alternative #1

Revenue for each project scenario is based on toll values developed to satisfy three objectives: (1) maximize toll revenues; (2) ensure that competing roadway patrons are not "tolled-off"; and (3) employ "value-priced", variable tolls.[12] This study examined value-price tolling for two time periods: peak and off-peak. Table 3.2-4 shows toll values used in the project scenario feasibility analysis.

Table 3.2-4 Optimized Toll Values(2)

	Project		Unimproved Roadways(3)									
			JRB		MMMBT		HRBT		Midtown Tunnel		Downtown Tunnel	
	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Scenario #1 HRX	0.20/mi	0.15/mi	2.00	1.40	2.00	1.40	2.00	1.40	-	-	-	-
Scenario #2 HRBT	0.25/mi	0.15/mi	0.75	0.55	0.75	0.55	0.75	0.55	-	-	-	-
Scenario #3 Midtown & MLK	2.05/mi. 0.25/mi(1)	1.50/mi. 0.20/mi(1)	-	-	-	-	-	-	2.05	1.50	2.20	1.60

(1) Values for MLK extension portion of project
(2) All toll values in Year 2004 US dollars
(3) If roadway is improved under the subject project, project toll rates in effect once construction has completed.

12 Appendix "C" – Discussion of Potential Travel Model Modifications, under the section "Sensitivity to Value-Pricing"

Using all the construction and financing assumptions previously described, debt-financing structures were prepared for each project combination. The results are summarized in Tables 3.2-5 and 3.2-6.

Table 3.2-5 Project Scenario Cash Flow

Project	Income		Expenditures		Excess Proceeds
	Toll Revenue (1)	NHS, RSTP, and Primary (1)	Operating & Maintenance Costs (2)	Debt Service (3)	
Scenario #1 HRX	10,999,324,600	-	1,504,274,600	7,575,533,100	1,919,516,900
Scenario #2 HRBT	7,102,864,800	-	993,866,400	4,732,739,300	1,376,259,100
Scenario #3 Midtown & MLK	4,827,149,800	-	709,110,900	598,681,800	3,519,357,100

(1) Portion used for operating revenue.
(2) Covers open road tolling infrastructure and toll administration (15% of gross toll revenues)
(3) Does not include capitalized interest (refer to discussion in Appendix "E")
Note: all values are US dollars at year of accrual or expenditure

Table 3.2-5 shows revenue income and expenditures. Note that for the project scenarios the share of gross toll revenues to fund operations and maintenance expenses is 15% as opposed to 30% assumed in the analysis of "stand-alone" projects. This reduction in operating & maintenance costs assumes that roadway maintenance costs will be paid by VDOT maintenance funds; leaving "open road" tolling infrastructure and toll administration costs.

Table 3.2-6 Project Scenario Capital Sources & Cost Summary

Project	Sources		Net Total Cost	Funding Deficit	Const. Start Date	Toll Revenue Start Date
	Toll Revenue (1)	Total Bond / Loan Funds				
Scenario #1 HRX	193,496,500	2,805,000,000	4,152,372,000	1,153,875,500	2006	2006
Scenario #2 HRBT	116,279,200	1,729,219,500	1,845,498,700	-	2006	2006
Scenario #3 Midtown & MLK	251,139,900	297,687,700	548,827,600	-	2009	2009

(1) Portion scheduled in the construction period
Note: all values are US dollars at year of accrual or expenditure

Table 3.2-6 shows capital sources and costs. Scenario #1 still has a significant funding deficit, even with the addition of "upfront" toll revenues. This added revenue, however, makes Scenarios #2 and #3 financially feasible. Scenario #3, in fact, was determined to be feasible with significant excess financing capacity (note large amount of excess proceeds), which means that it could be feasible at less than the stated toll rates. Only 37% of estimated toll revenue for Scenario #3 is required to cover costs. Toll values for the Midtown and Downtown Tunnel can be reduced from the $1.50 - $2.20 range shown in Table 3.2-4 to $0.35 - $0.55.

3.2.3 Financial Risk Assessment

There are a number of risks associated with toll road development. The financing plans for these projects are based upon estimates of costs and revenues. The exact values of these costs and revenues are not truly known and may well change over the lifetime of the project: the construction schedule may slip due to delays caused by environmental or other issues; the construction costs could increase due to poor estimation or unforeseen complications; or the traffic and revenue may not reach forecasted targets due to improvements of competing facilities or changes in travel behavior. A change in these input parameters can affect the financial feasibility of a project. Understanding these risks and their financial implications can help make a better-informed decision on whether to proceed with the project.

The risk assessment used a Monte Carlo simulation model with likely input parameter distributions[13] to generate 50,000 scenarios of input combinations and evaluated the impact of these scenarios on the project funding. This analysis considered the project funding in terms of funding deficit, since all of the stand-alone projects experienced a funding deficit,. Therefore positive funding deficits represent projects that require additional funding, while negative funding deficits indicate that a funding surplus exists. Using the 50,000 project funding observations, funding deficit measures were calculated for each project. The measures include the mean funding deficit, the mean funding deficit less one standard deviation, the mean funding deficit plus one standard deviation, the minimum observation, and the maximum observation. Also included is the "baseline" or deterministic deficit - the deficit presented in Section 3.2.1.

Table 3.2-7 "Stand-Alone" Project Risk Assessment

Project	Deficit					
	Baseline	Mean	Minimum Observation	Less One Std. Deviation	Plus One Std. Deviation	Maximum Observation
HRX, Segment I	1,750,677,800	1,754,997,352	2,065,319,115	1,841,708,259	1,668,286,446	1,484,762,795
HRX	3,815,567,900	3,700,229,471	4,786,522,326	3,971,288,466	3,429,170,477	2,773,736,550
Midtown & MLK	464,912,300	434,200,555	566,918,873	469,173,347	399,227,764	276,841,404
Route 460	902,375,200	832,306,443	1,388,259,829	972,789,433	691,823,452	121,905,024
Southeastern Parkway & Greenbelt	337,797,000	276,335,988	680,997,500	406,486,190	146,185,787	(432,852,758)

(1) Actual funding surplus reported here
(2) Deviation based on probable deficit range as compared to the calculated funding deficit
Note: all values are US dollars at year of accrual or expenditure

Table 3.2-7 presents the funding deficit measures for the stand-alone projects. Once again, all positive values indicate that a funding deficit exists. While most of the projects had a mean funding deficit that was less than the baseline deficit, the most likely

13 Appendix "F" – Project Specific Parameters

outcomes (between one standard deviation less than the mean and one standard deviation greater than the mean) of all stand-alone projects still constitute a funding deficit. In fact, only the Southeastern Parkway and Greenbelt project had any observations of a funding surplus. This finding further strengthens the concept presented throughout our analysis that financing of toll roads with only project generated toll revenue is costly.

The other interesting finding from this analysis is that the Hampton Roads Third Crossing – Segment 1 was the only project whose simulation mean represents a greater deficit than its baseline value. A review of the input parameter distributions suggests that the most likely reason for this higher mean is that the input distribution range of construction start year only contains values greater than the initial value of 2005.

Analysis results are more interesting for the project scenarios. Table 3.2-8 presents the simulated funding deficit measures for the combination projects. Again, positive values represent a funding deficit, while negative values signify a funding surplus. For Project Scenario 1, the simulation mean is a lower funding deficit than the baseline deficit. The likely outcome range (between one standard deviation less than the mean and one standard deviation greater than the mean) is a deficit from $42 Million to $1,833 Million. This range is larger than that for the Hampton Roads Third Crossing indicating that the "up-front" toll revenue from competing roadways contributes greater uncertainty to the financial feasibility assessment. While there are some observations of funding surplus, including the maximum observation of a surplus of $2,709 Million, the likely outcome range implies a deficit. These results lend support to the deterministic analysis that the project would experience a funding deficit.

Table 3.2-8 Project Scenario Risk Assessment

Project	Deficit					
	Baseline	Mean	Minimum Observation	Less One Std. Deviation	Plus One Std. Deviation	Maximum Observation
Project Scenario #1	1,153,900,000	937,616,814	4,096,268,214	1,832,746,950	42,486,678	(2,709,367,344)
Project Scenario #2	(144,954,174)	(291,683,437)	1,511,380,789	320,067,970	(903,434,843)	(2,695,160,975)

(1) Actual funding surplus reported here

(2) Deviation based on probable deficit range as compared to the calculated funding deficit

Note: all values are US dollars at year of accrual or expenditure

The outcome is different for Project Scenario 2. The deterministic financial analysis found that the toll revenue could fund the project. In fact, there would be a slight surplus on the order of $140 Million if all toll revenues were used. Again, the simulated mean indicates more capital funding compared to the deterministic analysis. The likely outcome range is from a funding deficit of $320 Million to a surplus of $903 Million. The simulation produced a minimum observation of a funding deficit of $1,511 Million and a maximum observation of a funding surplus of $2,695 Million. While the observations of a funding deficit may cause concern since the deterministic analysis found the project scenario could be funded, this should be considered in light of the fact that the 2 times bond/loan coverage ratio is required to protect against some of the less favorable combinations of inputs. All measures considered, the findings support the deterministic analysis that toll revenues collected from both the project and parallel projects would provide adequate funding.

Table 3.2-9 Funding Deficit Uncertainty

Project	Funding Deficit	Probable Deficit Range	Percent Deviation (2)
HRX, Segment I	1,750,677,800	1,668,286,400 to 1,841,708,300	-5% to +5%
HRX	3,815,567,900	3,429,170,500 to 3,971,288,500	-10% to +4%
Midtown & MLK	464,912,300	399,227,800 to 469,173,347	-14% to +1%
Route 460	902,375,200	691,823,400 to 972,789,400	-23% to +8%
Southeastern Parkway & Greenbelt	337,797,000	146,185,800 to 406,486,200	-57% to +20%
Project Scenario #1	1,153,900,000	42,486,700 to 1,823,747,000	-96% to 59%
Project Scenario #2 (1)	(144,954,200)	(903,434,800) to 320,068,000	-523% to 320%

(1) Actual funding surplus reported here

(2) Deviation based on probable deficit range as compared to the calculated funding deficit

Note: all values are US dollars at year of accrual or expenditure

Table 3.2-9 shows the probable variability in funding or financial feasibility based on a risk analysis performed for this study. A more detailed discussion of analysis methods, and assumptions can be found in Appendix “F”. Since the Project Scenario #3 is very well funded, an analysis of financial risk was not necessary. Note that the reported “stand-alone” project funding deficits are all in the higher portion of the probable deficit range – indicating that assumptions used in this study associated with project financing and operation are conservative.

4 TRANSPORTATION SYSTEM IMPACTS

Feasibility of toll implementation for the purposes of funding infrastructure improvements also constitutes an examination of the effect of tolls on travel demand. It is important to gauge the utilization of the tolled roadways – how much of the roadway capacity is being used. While roadway improvements are designed to alleviate congestion; if tolls are too high, travel demand for these roadways will be relatively low leaving a significant amount of excess capacity. The improvements the tolls are financing will therefore not sufficiently benefit the traveling public. Tolls may also cause travelers to deviate from tolled routes creating congestion problems on roadways that are part of competing routes. These effects can impact existing transportation plans and planning activities associated with other projects.

Specifically, this study intended to examine changes in roadway level-of-service and travel patterns associated with implementation and tolling of projects subject to financial analysis in the previous section. However, it is important to remember that this study analyzed project financial feasibility under conditions that maximize revenue and in many instances this assumption resulted in toll values that significantly reduced travel demand on project roadways. Travel demand impacts are therefore exaggerated in this study; practically, toll values on projects would be less with an implemented project. The travel impact analysis in this study can provide, however, useful qualitative information regarding the impact of the tolls and projects on travel demand.

4.1 Regional Impacts

Project impact on the system can be gauged by its impact on regional congestion. Table 4.1-1 below compares various measures of performance for the projects with the no project" condition. Project impacts to the system are not relatively great and in general; do not vary significantly between projects. Some projects provide for more efficient movement throughout the region as compared to the "no project" condition, while others improve the level of regional congestion, albeit slightly.

The connection provided between I-564 and I-664 by Segment I of the Third Crossing project (HRX, Segment I) clearly provides more efficient movement – VMT and free-flow VHT decrease. However, system delay increases with this project, indicating that while some movements are more efficient, this change in travel pattern creates congestion in locations that more than offset the benefits of the project. Southeastern Parkway and Greenbelt performs the best of the "stand-alone" projects. This project increases the efficiency of movement throughout the region, while minimizing an offsetting increase in congestion.

The only projects to offer a clear advantage over the "no project" condition are Project Scenarios #1 and #2. These projects provide a reduction in VMT, VHT and delay; indicating more efficient movement throughout the region while reducing congestion by as much as 5%. As discussed in Section 4.3, these benefits are more likely due to a spatial re-orientation of demand than route choice behavior caused by tolling roadways over the harbor that are parallel to the project improvements.

Table 4.1-1 Year 2026 Average Daily Mobility and Congestion

Project	Supply (lane-miles)	Measures of Performance				Operation Speed	
		VMT	Free-Flow VHT	Congested VHT	Delay	Free Flow	Congested
No Project	6,172	41,277,785	932,667	1,663,871	731,204	44.3	24.8
HRX, Segment I	6,204	40,841,757	918,956	1,677,599	758,643	44.4	24.3
HRX	6,269	40,376,434	912,765	1,673,962	761,197	44.2	24.1
MT-MLK	6,173	40,774,596	917,567	1,685,957	768,390	44.4	24.2
SP&G	6,299	40,790,623	917,841	1,660,695	742,854	44.4	24.6
RT 460	6,285	41,218,876	926,793	1,708,188	781,395	44.5	24.1
Proj. Scenario #1	6,269	39,414,665	895,912	1,578,657	682,745	44.0	25.0
Proj. Scenario #2	6,210	40,182,888	909,447	1,609,712	700,265	44.2	25.0
Proj. Scenario #3	6,173	41,223,208	930,423	1,684,795	754,372	44.3	24.5

VMT – vehicle-miles traveled; absent VMT from roads not included in the travel model
VHT – vehicle-hours traveled; absent VHT from roads not included in the travel model
Delay – difference between congested and free-flow VHT, in vehicle-hours
Speeds - calculated as VHT/VMT

4.2 Level-of-Service (LOS) Impacts

This study identifies 78 individual roadway segments to be evaluated as part of the study. Of those segments, 17 are related solely to build scenarios, and the remaining 61 links are for existing roadway segments. The result of the demand forecasting effort was Year 2026 No Project, “Stand-Alone”, and Project Scenario traffic volume forecasts for these segments. The volumes were provided as vehicles per day and were

directional. Volumes were provided for individual projects (original 61 segments plus those for each project), as well as predetermined project scenario combinations. Analysis methods and assumptions are detailed in Technical Appendix "G".

Table 4.2-1 Year 2026 PM Level-of-Service Impacts

Roadway Segment	No Project	HRX, Seg. I	HRX	MT-MLK	SP & G	Rt. 460	PS #1	PS #2	PS #3
Primary Impact Area									
Hampton Roads Bridge Tunnel	**F**	E	**F**	**F**	**F**	E	C	C	**F**
I-664, I-264 to Route 58	C	C	B	C	C	D	B	C	C
I-664, 23rd St to Aberdeen Rd	D	D	A	D	D	D	A	D	D
Midtown Tunnel	**F**	**F**	**F**	E	**F**	**F**	**F**	**F**	E
Route 460, I-664 to Route 58 Bypass	C	D	C	D	D	E	C	C	C
Oak Grove Conn. (from I-64 to Battlefield Blvd)	**F**	**F**	**F**	**F**	D	**F**	**F**	**F**	**F**
Proposed EW Connector, near I-664	-	C	A	-	-	-	-	-	-
Southeastern Parkway, Centreville Tpk to Indian River Rd	-	-	-	-	B	-	-	-	-
Southeastern Parkway, Oceana Blvd to I-264	-	-	-	-	A	-	-	-	-
Secondary Impact Area									
I-64, I-264 to Indian River Rd	D	D	D	D	D	D	D	D	D
Brambleton Ave, Colley Ave to Boush St	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**
Downtown Tunnel (I-264 from Portsmouth to I-464)	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	C
Jordan Bridge(Poindexter from Portsmouth to I-464)	E	E	E	E	E	E	E	E	**F**
I-64, Route 199 @ Lightfoot Rd. to Camp Peary Rd.	D	D	D	D	D	C	D	D	D
I-264, Witchduck Rd to Independence Blvd	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**
Dam Neck Road, Holland Rd to London Bridge Ext	**F**	**F**	**F**	**F**	D	E	**F**	**F**	**F**
Birdneck Rd., I-264 to VA Beach Blvd	E	E	E	E	E	E	E	E	E
Battlefield Blvd., Great Bridge Bypass to Volvo Pkwy	E	D	D	D	**F**	D	D	D	D
Kempsville Rd., Centreville Tpk to Indian River Rd	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**
Indian River Rd., I-64 to Centreville Tpk	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**
Oceana Blvd., Gen Booth Blvd. to Tomcat Blvd.	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**

Analyses were conducted for the PM peak hour for all freeway segments analyzed and both AM and PM peak hours for all other segment types. The freeway analysis were conducted utilizing the highest directional ADT volume forecasted and assuming a 100 percent directional split. Therefore, only one peak period was analyzed and was reported as the PM peak. Analysis results for all roadway segments can be found Technical Appendix "G". Table 4.2-1 shows PM peak LOS at several key roadways associated with the proposed projects and their impacts areas. As indicated in the Table, most LOS improvement is confined to the roadway segments that are being improved.

For some of the projects a very good level of service may be an indicator of capacity that is under utilized. The secondary impact areas are relatively unchanged. These patterns of LOS changes may be the consequence of using larger toll values that maximize revenues – travelers are unwilling to divert from congested roadways to use the tolled roadways.

4.3 Travel Pattern Impacts

This study includes an examination of travel pattern impacts for the components of both project packages using "reduced" tolls. A tabular summary of travel pattern changes can be found in Technical Appendix "H".

4.3.1 Methodology

Trip origin-destination difference tables were produced for each stand-alone project and project combination, based on the "no-project" condition in Year 2026 between each of the 14 localities or jurisdictions in the Hampton Roads area. The trip distributions were provided as trips per day. A tabular comparison was made between the No Build scenario and an individual project scenario to show the percent change in trips between the localities and the change in the actual number of trip ends. Those changes over 10% and over 1000 trip changes per day were flagged as a major change in a user's decision to travel between the localities due the presence of a project. Graphics displaying travel pattern differences are located in Technical Appendix "H".

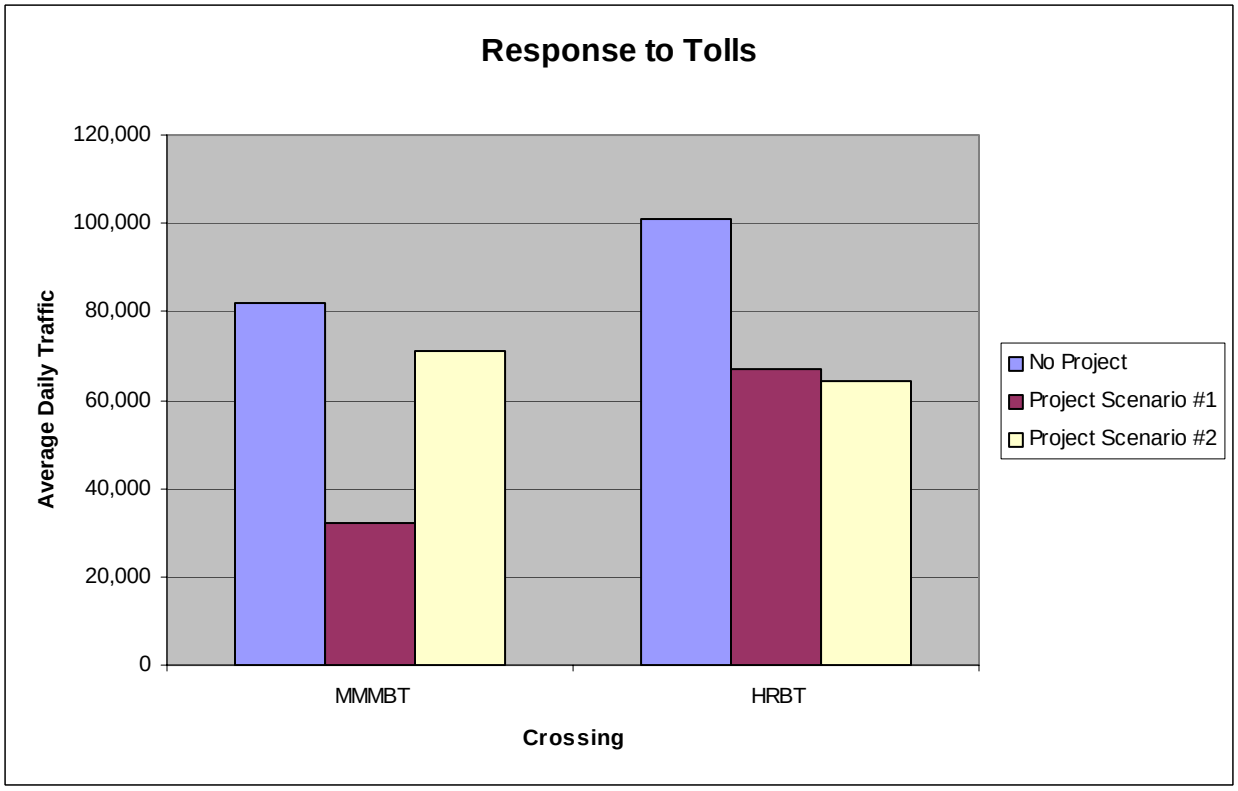
4.3.2 Analysis Results

The inclusion of tolled roadways will provide incentive for travelers to change destination locations in an attempt to minimize their generalized cost of travel (time and tolls). Although small travel pattern changes can be found throughout the region for all projects, a distinct pattern change associated with Project Scenarios #1 and #2 is evident – a re-orientation of travel demand away from travel between the York Peninsula and the Southern Hampton Roads region.

Figure 4.3-1 clearly shows a reduction in demand across the harbor. Under Project Scenario #1 the Monitor Merrimac Bridge Tunnel demand decreases by more than 50% while capacity on the roadway increases due to improvements. The Hampton Roads Bridge Tunnel behaves in a similar fashion for both of the project scenarios. Note that

in project scenarios #1 and #2, the James River Bridge was tolled as well. This reduction in demand is not due to route diversion, but a re-orientation of demand – with tolls, travelers are finding it too expensive to cross the harbor and satisfy the purpose on their trip by going to destinations on either side of the harbor. Technical Appendix "G" provides more detailed information regarding re-orientation of demand.

Figure 4.3-1 Harbor Crossing Reductions



Technical Appendix

Appendix A

Letter from Phil Shucet; July 16, 2003

HRPDC
ORIG COPY

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, VIRGINIA 23219-2000

PHILIP A. SHUCET
COMMISSIONER

July 16, 2003

Mr. Louis R. Jones, Chairman
Metropolitan Planning Organization
c/o Mr. Arthur L. Collins, Executive Director/Secretary
Hampton Roads Planning District Commission
723 Woodlake Drive
Chesapeake, VA 23320

RE: Draft 2026 Hampton Roads Regional Transportation Plan

Dear Mr. Jones:

In a letter dated June 24, 2003 from Mr. Arthur Collins, the Department was asked to determine if the "Draft" 2026 Hampton Roads Regional Transportation Plan adopted by the MPO during its meeting on June 18, 2003 meets the fiscal constraint requirements of the Federal Transportation Planning regulations. Our review of the draft plan, along with the assumptions used to produce it, indicates that the plan, as currently configured, does not meet the requirements for fiscal constraint. Specifically, we find that the reliance on a regional gas tax is not a reasonably foreseeable source of revenue for the current plan update.

The Department previously furnished the MPO staff with estimates of funding revenues that, in our judgment, are reasonably expected to be available to carry out the 2026 Regional Transportation Plan. Also, in their letter dated April 8, 2003, the Federal Highway Administration (FHWA) offered guidance regarding funding sources for the current plan update.

We are committed to work with you to adopt a plan that meets fiscal constraint requirements. To that end, we are willing to consider tolls as a source of revenue for certain recommended improvements in the regional transportation plan. I suggest that the staffs of the MPO and VDOT work cooperatively to determine which recommended improvements might be appropriately considered for toll revenue funding.

Regarding the projects that might be funded with revenue sources other than tolls, we encourage you to display these in any fashion you wish, but outside the context of a fiscally constrained plan. While such projects are frequently described in an "illustrative" plan or "vision" plan, we invite you to select a name of your choice for these additional projects, as long as it is clear that they fall outside the confines of a fiscally constrained plan.

HRPDC
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Mr. Louis R. Jones
July 16, 2003
Page Two

To meet the timeline required for the final adoption of a fiscally constrained long-range plan that meets the requirements for air conformity, we urge you to revise your draft plan as soon as possible.

I want to assure you that VDOT stands ready to assist you in any way possible as you complete the planning process.

Sincerely,

Philip A. Shucet
Commissioner

cc: Honorable Whittington Clement
Mr. Roberto Fonseca-Martinez
Mr. Arthur Collins
Mr. George Wallace
Mr. James Spore
Ms. Susan E. Schruth, FTA
Ms. Karen J. Rae, VDRPT
Commonwealth Transportation Board Members

Appendix B

Letter from FHWA; April 8, 2003

U. S. Department
of Transportation

**Federal Highway
Administration**

Virginia Division
(804) 775-3320

400 N. 8th Street, Rm. 750
P. O. Box 10249
Richmond, VA 23240

April 8, 2003

Mr. Louis R. Jones, Chairman
c/o Mr. Arthur L. Collins, Executive Director
Hampton Roads Planning District Commission
723 Woodlake Drive
Chesapeake, Virginia 23320

Dear Mr. Jones:

In response to a request from Mr. Dwight Farmer of your staff, the following information clarifies our position on the financial constraint of the Hampton Roads 2026 Long Range Plan. We have significant concerns about the various funding scenarios being presented to the MPO for consideration as part of the financially constrained plan. As you are aware, 23 CFR 450.322(b)(11) requires that all long-range transportation plans include a financial plan that "demonstrates consistency of proposed transportation investments with already available and projected sources of revenue." This requirement is particularly critical in air quality non-attainment and maintenance areas, such as Hampton Roads, in order to ensure implementation of projects and programs to help attain air quality compliance goals. The information which has been discussed thus far at the MPO includes combinations of tolls and taxes to provide additional revenues. I would like to address each of these strategies in detail.

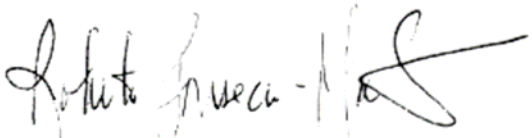
Tolls - In the presentation to the MPO on March 19, 2003, your staff proposed tolling a number of facilities in the region. Of those proposed, I am concerned that you have specifically included I-64 on the Peninsula. As discussed in detail in our letter of December 6, 2002, Section 129(a) of Title 23, United States Code prescribes where tolls can be implemented on the Interstate system. Tolls are not permitted on the Interstate system, except where there is substantial reconstruction or rehabilitation of a bridge or tunnel facility. I-64 on the Peninsula would not qualify for this exemption. The letter also discussed Section 1216(b) of the Transportation Equity Act for the 21st Century which established the Interstate Toll Pilot Program. Under this program, a State may collect tolls on an Interstate highway for the purpose of reconstructing or rehabilitating an Interstate highway that could not otherwise be adequately maintained or functionally improved without the collection of tolls. The pilot program provided for a maximum of three projects nationwide and they must be in different states. The Commonwealth of Virginia has submitted an application under this pilot program for the I-81 corridor. This application has received conditional approval by FHWA. Therefore, it is not reasonable to assume that tolls can be implemented on I-64 on the Peninsula. Additionally, in our letter of December 6, 2002, we also stated that "any inclusion of toll revenues in the financial plan for the 2026 Hampton Roads Long Range Transportation Plan would need to have written concurrence from the Virginia Department of Transportation." I would expect to see this written concurrence well in advance of submittal of the plan document for a conformity determination.

Taxes - The MPO is also considering funding scenarios that include the imposition of regionally specific taxes on sales and/or gasoline. It is our understanding that under current State law, changes to sales or gasoline taxes (including regionally specific taxes) must be approved by the Virginia General Assembly. A regional sales tax proposal was approved by the Virginia General Assembly in the 2002 session and subsequently failed in a referendum was held in November 2002. Given that neither the local jurisdiction nor the MPO have the legal authority to impose such taxes, and that previous attempts to impose such taxes have failed, we do not believe it is reasonable to assume this revenue as an assumption of the financial plan for the 2026 plan. However, if there is documentation of pending action by the Virginia General Assembly to provide for these revenues or to provide such authority to the MPO we will reconsider the acceptability of new taxes as part of the financially constrained plan.

If the MPO chooses to present alternative revenue scenarios as part of an effort to fund the unmet transportation needs in the region, it is appropriate to include these scenarios in a vision plan or list unfunded projects or portions of projects in the plan as illustrative projects. The MPO would only be able to move forward into the TIP those projects which are included in the constrained portion of the plan and only those projects would be considered in the conformity analysis. However, should additional funding become available, the MPO could move projects or phases of projects into the constrained plan by vote of the MPO and a subsequent conformity finding (if the projects are not neutral).

I hope this clarifies our concerns regarding the proposed alternative revenue sources. Our office must make a determination on whether or not the plan is financially constrained when the plan is submitted for a conformity finding. In addition, we must make a finding that the plan meets all Federal laws and regulations when approving the TIP. Unless our concerns are satisfactorily addressed, we will be unable to make either finding on the Hampton Roads 2026 Long Range Transportation Plan and Federal funds would not be available for projects within the Hampton Roads MPO area. As always, my staff is available to assist you with this or any other planning related issue. If you have further questions on this issue or others related to the planning process, please contact Jennifer DeBruhl of my staff at (804) 775-3335.

Sincerely,



Roberto Fonseca-Martinez
Division Administrator

Attachments

cc: Philip A. Shucet
Jane Wimbush

Appendix C

Travel Demand Forecasting – State of Practice Review

Hampton Roads Regional Travel Demand Model

Discussions of Potential Travel Model Modifications

Travel Model Modifications Implemented For This Study

State-of-Practice Review

The Transportation Planning community has a long history of developing and sharing travel demand forecasting model practices and improvements. This Study uses information and experience, confirmed and supplemented by a literature review, to assess the suitability of the regional model system and possible model enhancements for this project.

Automobile Demand Elasticities

The most important model function for this project is the capability to accurately predict the level of route diversion caused by tolls. This topic has been the subject of numerous studies, including three studies that each reviewed and compiled the findings of a number of independent projects. These studies imply a full range of elasticities from -0.03 to -0.5. Study elasticities are shown in Table C-1.

Table C-1 Demand Elasticity Studies

Author	Elasticity Values	Basis
Goodwin[14]	-0.16 to -0.5	Fuel Price
Oum[15]	-0.13 to -0.45	Automobile Usage
Burris[16]	-0.03 to -0.35	Tolls

While it is useful to consider these elasticity values to evaluate the travel model's performance, there should be caution in doing so. Since traveler's behavior to tolls are not expected to exhibit constant demand elasticity[17], the elasticity value just represents the elasticity at the point of measurement. Further, each of the three compilations include independent projects with their own observations of elasticity values, which could be based upon differing methodologies,[18] and each compilation could use different approaches for determining each range.[19] There is also the complication as to

14 Goodwin, P. B., "A Review of New Demand Elasticities with Special Reference to Short and Long Run Effects of Price Changes", *Journal of Transport Economics and Policy*, Vol. XXVI, No. 2, May 1992.

15 Oum, Tae Hoon, W. G. Waters II, and Jong-Say Yong, "Concepts of Price Elasticities of Transport Demand and Recent Empirical Estimates", *Journal of Transport Economics and Policy*, Vol. XXVI, No. 2, May 1992.

16 Burris, M. W., "The Toll-Price Component of Travel Demand Elasticity", *International Journal of Transport Economics*, Vol. XXX, No. 1, February 2003.

17 In reality, individuals' values of time are not constant – people are more willing to pay when saving a large amount of time.

18 For instance, point elasticity is computed differently than arc elasticity.

19 For example, Goodwin considered elasticity of automobile travel with respect to fuel, while Burris

which demand is being measured – the true (OD) demand or the demand exhibited for the facility. Elasticities measuring this latter type of demand are also dependent on other factors that influence the route demand, particularly the network topology, in addition to the monetary fee. These factors cause some degree of incompatibility when comparing demand elasticities with each other and with the demand model results. This Study examines elasticity values calculated from the model results for a series of toll sensitivity experiments, and consider them in light of reference elasticity values found in literature. These reference values are not presented to be the criteria for preparing the demand forecasting model for the project, but rather as a backdrop against which to consider the values predicted by the model.

Value of Time and Vehicle Operating Cost

For highway assignment, the Hampton Roads travel demand model uses a generalized travel cost function to convert all elements of travel disutility into a common unit (cents). To do so, the function relies upon two factors – the value of time (VOT) and vehicle operating cost (VOC). The VOT is used to convert travel time into a cost unit. The version of the demand model run by the HRPDC currently uses a VOT of $16.64 / hour in year 2000 dollars. A general guideline is that the VOT is somewhere in the range of one-quarter to one-half of the average wage rate. According to the U.S. Census Bureau, the median annual household income was $42,472 in 2000 for the Norfolk-Virginia Beach-Newport News MSA.[20] Following the procedure specified by the U.S. Department of Transportation, this converts to an hourly wage rate of $21.24.[21] The general guideline would then suggest a VOT between $5.31 and $10.62 / hour.

Thus, the state of practice suggests that VOT used by the Hampton Roads model is too high relative to the wage rate. Recall that use of high values of time was one of the common features of projects whose actual traffic and revenue failed to meet projections. It is important to note that this relatively high VOT has not caused problems in previous model uses because those studies were not focused on toll usage. Rather, the VOT was used to convert travel time to cost in order to balance it against the travel distance as converted to cents by the VOC. However, moving forward with this project, it is essential that the model's VOT be revised to values that are more applicable in a toll

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considers demand elasticity with respect to tolls.

20 Virginia's Electronic Labor Market Access, http://www.velma.vec.state.va.us/vecweb/poptot/390515720.pdf, last viewed July 2, 2004.

21 U.S. Department of Transportation, Office of the Secretary of Transportation, "Departmental Guidance for the Valuation of Travel Time in Economic Analysis", found at http://ostpxweb.dot.gov/policy/Data/VOT97guid.pdf, July 2, 2004. This document describes calculation of the hourly wage rate as "median annual household income, as reported by the Bureau of the Census, divided by 2,000 hours." The document also discusses how to determine the VOT from this hourly wage rate by applying factors. However, it is not recommend using the values implied by these factors as a basis for critiquing the model's value because of the fundamental difference in the purpose of VOT calculation – the "Guidelines" are for benefit evaluation, while our project will use VOT as a behavioral predictor.

road context.

Another important VOT consideration is the value associated with commercial vehicle traffic. Based on compiled findings of a number of truck value-of-time studies it is found that an average truck VOT is $25.55; in addition a stated-preference survey identified a truck VOT of $49.42.[22] These values are both higher than the $18.10 / hour provided by the U.S. DOT in its recent update to the Value of Time guidelines,[23] and all of these values are higher than the rate effectively applied to trucks in the current model.[24] The next section discusses the impact of this difference in VOT.

As mentioned earlier, the operating cost factor is the other parameter needed by the generalized travel cost function, and it is used to convert travel distance into a monetary cost. The model system currently uses a value of $0.10 / mile.[25] This factor has also been a topic of discussion in the literature. The Victorian Transport Policy Institute references a VOC value of $0.12 / mile and a range from $0.115 / mile to $0.148/ mile, the former from an internal study and the latter from the American Automobile Association.[26] In light of this, the value used in the model, $0.10 / mile, appears very reasonable.

Traffic Impact of Toll Collection

Historically, introduction of new toll roads have been opposed not only due to the tolls charged, but also for the delays that may be caused by collection of these tolls. With the advancement of ITS, the latter is becoming less of an objection, and would most certainly not be a credible objection by the planned opening of any of the proposed toll facilities examined in this study. Open Road Tolling (ORT) is a technology that uses transponders mounted in vehicles to collect tolls as vehicles pass the collection point at full speed. This technology has already been installed in such places as Florida[27], as well as Georgia and Oklahoma.[28] At these facilities, ORT has been shown to cause little to no impact on the speeds and capacities of the facilities. It is envisioned that all of

22 Smalkoski, Brian and David Levinson, "Value of Time for Commercial Vehicle Operators in Minnesota" Transportation Research Board International Symposium on Road Pricing, Key Biscayne, Florida. November 20-22 2003.

23 U.S. Department of Transportation, Office of the Secretary of Transportation, "Revised Departmental Guidance for the Valuation of Travel Time in Economic Analysis" distributed by Memorandum February 2003, Tables 1 and 3. Found at http://ostpxweb.dot.gov/policy/Data/VOTrevision1_2-11-03.pdf, last checked July 2, 2004.

24 Since trucks are not separated from other trips, they use the same $16.64 / hour VOT.

25 To support model validation, this value has been cut in half for certain link classes when applied in the generalized travel cost equation.

26 Victorian Transport Policy Institute, "Vehicle Costs", *Online Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications,* (http://www.vtpi.org/tca/tca0501.pdf), 2003.

27 Pustelnyk, Steve. "Express to success: Electronic toll collection plaza design allows for high-speed, open-road tolling", *Roads & Bridges*, September 2000.

28 Majdi, Saïd, "Open Road Tolling", *ITS American Newsletter*, Vol. 12, No. 5, May 2002.

the candidate projects would be equipped with this advanced tolling technology, and thus there is no reason to include a toll collection delay in the network representation of these facilities.

Hampton Roads Regional Travel Demand Model

This section discusses the model system and its application for this study. The Hampton Roads model is a traditional four-step travel demand model, and was translated to the TP+ development platform in its most recent model update. The model includes approximately 1,000 traffic analysis zones, three trip purposes (Home Based Work, Home Based Other, and Non-Home Based), HOV / SOV distinction, and a full daily traffic assignment. The model system has undergone extensive validation and has served as the basis for numerous regional studies.

Ideally, in the study of travel demand and revenue potential of new toll road facilities, one would develop more detailed tools that utilize additional data to address the assumptions inherent in the regional model that are critical for accurately predicting traffic and revenue. However, in the context of this study as the first step of analyzing toll road feasibility, a modified version of the current regional transportation model is the primary basis for analysis of tolled roadways.

A number of challenges present themselves when using this regional model in a toll road study:

- *Limited Toll Road Observations* - The model system was developed and calibrated with data from only one toll facility in the study area – the Chesapeake Expressway. This limited the calibration and validation of the model with respect to tolls. It should be noted that the Chesapeake Expressway is often used by vacationers traveling to the Outer Banks of North Carolina, as opposed to commuters who will comprise the primary target market for the proposed toll facilities associated with this study. These two travel market segments typically exhibit different behavior, particularly with respect to value-of-time.
- *Uniform Value of Time (VOT)* - Another limitation of the model system is that the generalized travel cost function used for converting all elements of travel disutility into common units is the same regardless of trip purpose. This implies that all travelers value their time the same, regardless of the trip purpose.
- *Daily Highway Assignment* – Typically, it is during the morning and evening peak periods that toll facilities offer the largest travel timesavings and are most attractive, but daily assignment blends the peak and off-peak periods together.
- *No explicit Truck Traffic* - Truck traffic is not explicitly separated in the model, but rather is blended with passenger vehicles. Trucks are presumably one of the intended target segments of the proposed toll facilities, and not explicitly differentiating them may limit the model system's ability to forecast traffic and

revenue.

This study needs to adapt the travel model in a way that best addresses these challenges while maintaining the overall integrity of the model. Like other regional models, the Hampton Roads travel demand model has been used for several other studies, and thus wholesale changes that substantially deviate from the fundamental travel model characteristics as used for those other studies should only be pursued under extreme circumstances. Instead, this Study recommends a series of adaptations that maintain the overall integrity of the model. This Study considered several such adaptations, ultimately implementing those most effective with respect to modeling tolled roadways within this study's constraints. This implementation benefited from a state-of-practice review and a series of experiments performed to assess the performance of the model system and our adaptations in various tolling situations, ultimately using these findings to offer a set of recommended model adaptations.

Discussion of Potential Travel Model Modifications

Building on the discussion of the challenges of using the regional model for this project and the state of practice review of conventional toll modeling parameters, this section identifies potential model modifications needed for this study, and discusses the complexity of such adaptations and their likely impact on model performance.

Development of Route Diversion Model

Often, toll behavior has been modeled using route diversion models, which determine the probabilities of travelers choosing to use each alternative route. These types of models consider the attributes of each route, such as travel time, travel distance, and toll levels, to estimate the utility a traveler would experience from using that route, and then compute the probabilities of route usage based upon those utilities. The probabilities of route usage are then used to establish the shares of trips using each facility, and this whole process is performed outside or as a component of the highway assignment process in order to more directly address the use of the toll facility. These types of models offer advantages over the current model approach, which relies on highway assignment to account for each facility's attributes, and ultimately usage. However, developing such a model for this study would require substantial effort and new data collection, and is outside the scope of this study.

Highway Demand Assignment by Trip Purpose

Individuals' travel behavior varies depending on the purpose of their trip. The Hampton Roads travel model differentiates travel demand into the following purposes: Home-Based Work, Home-Based Other, and Non-Home Based. Travelers making Home-Based Work trips are likely to exhibit different behavior than for Home-Based Other trips, particularly with respect to their value of time. Despite the categorization of demand by trip purpose, in the travel model, trips are aggregated together for highway

assignment. A better representation of travel behavior would be to modify highway assignment to disaggregate demand by trip purpose.[29] Implementation of this change also requires an adjustment to the end of mode choice processing so that a trip table for each purpose is produced for highway assignment. The highway assignment module in turn needs to be adjusted to accommodate the additional trip purpose trip tables and to include a separate generalized travel cost specification for each trip purpose. This modification is practical to implement for this study. Based on experiments conducted for this study, this modification did not adversely affect estimated roadway patronage compared to observations in the base year.

Trip Purpose-specific Value of Time (VOT)

In coordination with the development of trip purpose-specific highway assignment, a separate generalized travel cost specification for each purpose can reflect trip purpose-specific VOT. The enhancement to perform trip purpose-specific assignment mechanically enables the treatment of each trip purpose differently and makes practical the consideration of different VOTs to each trip purpose in this study. There are many possible VOTs that can be used, and in this study different values were tested, while assessing their impacts on the performance of the travel model.

Update Vehicle Operating Cost Parameter

In addition to VOT, the vehicle operating cost (VOC) is another term in the computation of generalized travel cost. As the discussion in the literature review section noted, the model system currently uses a VOC of $0.10 / mile, while the literature recommends values of roughly $0.12 / mile. The current value seems appropriate when considering that the current model specification applies to all trips, and the average vehicle occupancy associated with those trips.[30] The use of separate generalized travel cost specifications by trip purpose also accommodates different VOCs, by trip type.[31.] This study evaluates the impact of this change and its impact on the performance of the travel model.

Sensitivity to Value-Pricing

Through the Value Pricing Pilot Program, FHWA is promoting the use of market-based approaches for alleviating congestion problems. Particularly relevant to this study, is the program element that allows for tolling on existing interstate highways, provided that variable tolls are used. Variable tolls are tolls that change depending on the level of congestion, such that higher tolls are charged during more congested periods.

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29 Note that by considering each trip purpose separately, variations of the generalized travel cost function can be applied by trip purpose. This does not mean that each trip purpose will be assigned independently, since the effects of the combined trip purpose link volumes will be used to determine the effective travel speeds within the equilibrium assignment.

30 The $0.12 / mile roughly equals the $0.10 / mile for vehicle occupancy of ~ 1.2.

31 Notably SOV, HOV, and external trips.

The most sophisticated variable tolling initiatives adjust the toll in real time according to the current traffic conditions, while a more simplistic approach varies tolls by time of day based upon the average level of congestion during that time period. It is ideal to vary tolls values depending on the level of congestion, but given the available forecasting tool, the daily travel demand model, there is need to develop a more basic approach.

The value pricing methodology could be based on two premises:

1. A higher toll during the peak period, and
2. Travel conditions are more congested during the peak period.

A simplifying assumption is to treat all HBW and HOV trips as peak period trips. This assumption allows us to apply a different toll to these trips. Thus, the first premise of the methodology entails applying a *peak premium rate* to the tolls charged to HBW and HOV trips through the generalized travel cost equation in the daily travel model. This peak premium rate can be set as part of the process that determines the toll rate that maximizes revenue.

The second premise can be addressed in two stages. First, use a *peak volume factor* in the calculation of link travel times to determine a *travel time adjustment factor*. Next, apply this travel time adjustment factor in the generalized travel cost expression to represent the more congested travel times experienced in the peak period. As this process would suggest, implementation would require the determination of the peak volume factor in advance.

Generalized Travel Cost in Trip Distribution

In addition to accounting for travelers' route choice behavior associated with tolled roadways, it is also important to consider the impact of tolls on trip distribution.[32] The trip distribution step in the regional travel model determines travel demand orientation, geographically, between different locations in the Hampton Roads region. In the Hampton Roads model and most travel models, this determination is dependent on a measure of "spatial separation" between locations in the region. If the separation between two locations in the region is large, demand between the locations will be relatively low and vice versa. In the current regional travel model, travel time between the various locations in the region defines this separation – thus trip distribution is not sensitive to the impact of tolls on demand orientation. It is conceivable that with the introduction of tolls to one or more of the harbor crossings, that some commuters will find the trip too expensive to accommodate on a daily basis and will "re-orient" their travel such that they do not need to cross the harbor – preferring to live and work on the Peninsula or Southside areas of the region.

It is important to account for this demand re-orientation behavior in the regional travel model if the study is to credibly account for the affects of tolls associated with estimated demand/revenue and transportation system impacts. Accounting for this travel behavior

32 Especially when tolled roadways are major facilities such as interstates and principal aterials

requires generalizing the definition of spatial separation used by the trip distribution model to include travel costs other than time – explicitly tolls. The need for this modification has to be balanced with its practicality. Changes in this definition of separation or generalized cost used by the trip distribution model could theoretically change average regional trip lengths and change estimated demand orientation to the extent that a comprehensive model recalibration is necessary. A comprehensive model re-calibration is outside the scope of this study.

Speed Feedback

Another consideration associated with implementation of generalized costs in trip distribution is the consistency of speeds or travel times used by trip distribution and trip assignment in the regional model. The current regional model uses speeds in trip distribution and assignment that were manually adjusted to be consistent in the base year. In this type of model there is no guarantee that speeds will be consistent in scenarios other than those associated with the base year land use and infrastructure description. This limitation of the regional model was deemed as not adequate in the context of this study for estimating tolled roadway demand. Without an automated way to adjust speeds used in trip distribution, the travel model cannot account for a possible re-orientation of demand arising from changes in the travel time component of generalized cost.[33] Although a significant undertaking, this Study implements an auto-convergent feedback loop between trip distribution and trip assignment. This feedback loop updates travel speeds using the "method of successive averages" and uses a convergence criteria sanctioned by Federal guidelines.[34]

Several experiments were conducted for this study with variations in the definition for generalized cost. These experiments examined the response of the trip distribution model to tolls and evaluated impacts on average trip lengths and demand orientation compared to those observed in the base year. All but one formulation of generalized cost was shown to require a comprehensive model re-calibration. This formulation calculates generalized cost in units of time, including time and toll value as its components and is sensitive to changes in VOT by trip purpose.[35] This formulation was used in the study.

Heavy Vehicles

As noted earlier, the Hampton Roads model does not explicitly consider truck trips. This poses another challenge for accurately predicting tolled roadway demand and

33 Demand re-orientation due to the presence of tolls (as previously discussed) can reduce congestion on some roadways, thus increasing travel speed; reducing the travel time component of generalized cost and in effect countering, in some cases, the demand re-orientation effect that tolls have.

34 Ninety-five percent of network links vary less than five percent in assigned volume from the previous feedback iteration

35 Albeit outside the study area, this formulation of generalized cost was shown to improve the model's estimation of travel behavior associated with Coleman Bridge crossings

revenue in light of significant heavy vehicle activity. This region includes a substantial amount of heavy vehicle trips due to the presence of local ports. The ports of Norfolk and Newport News are among the Top 50 U.S. ports in terms of total tonnage[36] and Top 25 in terms of containerized cargo.[37]

Heavy vehicles are implicitly included in the travel demand model by their inclusion in the data used for developing non home-based travel, the external trip table, and the traffic counts used for calibration and validation.[38] Ideally, heavy vehicles would be explicitly represented, but the most common methods for doing so – various surveys of truck drivers and truck movements – are beyond the scope and timeframe of this project. Alternately, a procedure similar to the one detailed in the Federal Highway Administration's *Quick Response Freight Manual* could be used, but this procedure would still require significant effort to estimate freight trip tables and extensive model recalibration, and likely fail to accurately represent freight traffic associated with the ports.[39]

When considering the current model specification in terms of its impact on toll modeling; the model treats heavy trucks like any other vehicle - heavy vehicles will be charged the same toll rate and will use the same value of time as other non home-based vehicles. This effective lower toll rate will have the mixed effect on predicted revenues: it will understate the revenue of each effective heavy vehicle, but overstate the number of those vehicles that would use the toll facility.[40] As previously noted, heavy vehicle VOTs found in the literature are substantially higher than the VOT for work trips.[41] Since in reality, this higher VOT will be used to consider the travel time savings from the toll facility against the larger truck toll rate, it is not clear what the net impact would be on the number of truck trips that use the facility, let alone the resulting toll revenue calculated with the higher toll rate. In light of these circumstances, the associated risk of increasing model uncertainty and the scope of this study, there is no compelling reason to dedicate substantial effort to altering the model to account for heavy vehicles.

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36 U.S. Army Corp of Engineers, http://www.iwr.usasce.army.mil/ndc/fatcard/fc02/fcvesage.htm, last checked June 21, 2004.

37 Port Import Export Reporting Series (PIERS), posted at http://www.marad.dot.gov/Marad_Statistics/C-Port-Tot.html, last checked on July 2, 2004. Note that containerized cargo generally includes substantial intermodal connections with trucks.

38 But note that they were considered without any passenger car equivalency factors.

39 Cambridge Systematics, Comsis Corporation, and University of Wisconsin-Milwaukee, *Quick Response Freight Manual,* prepared for Federal Highway Administration, September 1996. In case of the Hampton Roads model where employment data is only maintained at the retail and non-retail levels, this manual recommends applying standard rates to estimate employment by needed categories. This approach would under-represent transportation employment and ultimately trips associated with the ports.

40 The number of vehicles would be overstated since the decision in the model is based on a lower toll than what would be charged for trucks.

41 As noted in the State of Practice Review section, a range of truck VOTs were found from $18.10 to $49.42 per hour, compared to the current model's VOT of $16.64, which was also noted to be high.

Travel Model Modifications Implemented For This Study

State of the practice guidance suggests there are model modifications appropriate for this study. The model's performance with the following enhancements has been examined and deemed acceptable:

1. Modification of Trip Distribution – requires generalizing the definition of spatial separation used by the trip distribution model to include tolls so that model is sensitive to the impact of tolls on demand orientation. This new definition calculates cost in units of time, including time and toll value as its components and is sensitive to changes in VOT by trip purpose.
2. Modification of Highway Assignment – change highway trip assignment so that each of the following trip purposes and types is treated separately and sensitive to changes in VOT by trip purpose: Home-Based Work, Home-Based Other, Non Home-Based, HOV, and external trips.
3. Modify the values-of-time and vehicle-operating costs used in estimating generalized cost associated with trip distribution and highway trip assignment in accordance with values shown in Table 2.1-1. Values-of-time are used in distribution and assignment; vehicle-operating costs are used only in assignment.
4. Add a *peak period volume factor*, in the calculation of link travel times and apply this factor in the generalized travel cost expression to represent the more congested travel times experienced in the peak period.
5. Implement an auto-convergent feedback loop between trip distribution and trip assignment.

Table C-2 Trip Distribution/Assignment Parameters

Trip Purpose	Value-of-Time(1)	Vehicle-Operating Cost(2)
Home-Based Work	$7.43	$0.12
Home-Based Other	$3.72	$0.10
Non-Home Based	$7.43	$0.10
HOV	$14.87	$0.06
External	$7.43	$0.10

(1) Year 2000 US dollars per hour
(2) Year2000 US dollars per mile

Appendix D

Derivation of Peak Period Volume Factor

Calculation of Full Revenue Schedules

Derivation of Revenue Annualization Factors

Derivation of Peak Period Volume Factor

Diurnal travel data collected for the development of the regional model was used to derive the peak period volume factor. The percentage of HBW trips that occur during the peak periods, which were identified as the consecutive three AM and three PM hours with the highest total trips (AM peak from 7am – 10am and PM peak from 3pm – 6pm[42]), constituted 57.9% of total HBW trips. The peak period factor, the ratio of the percentage of average hourly daily trips occurring in a peak period hour against the percentage of daily trips in an average hour, was calculated as follows:

- Peak hour share = (4,912 peak period trips) / (11,000 daily trips) / 6 hours = 7.44% of trips
- Average hour share= 100% / 24 hours = 4.17% of trips
- Peak period factor = 7.44% / 4.17% = 1.79

Finally, the peak period factor was adjusted to account for the HBW trips that occur outside the peak periods. This adjusted peak volume factor was calculated as follows:

$$\text{Adjusted Peak Volume Factor} = 1 + (1.79 - 1) * 57.9\% = 1.46$$

Thus, this Study uses a peak volume factor of 1.46 in our value pricing methodology. Adjusting the travel times for the non-HBW trips was also considered, however the distribution of these trips is nearly uniform throughout the day, implying an "off-peak" factor of 1.0.

Calculation of Full Revenue Schedules

The regional travel demand model has data available to produce Year 2000, 2017 and 2026 demand estimates and thus revenue. For the stand-alone projects, the model years 2017 and 2026 serve as reference points to calculate yearly revenue growth using linear interpolation, where:

$$\text{Growth}_{2017\text{-}2026} = (\text{Revenue}_{2026} - \text{Revenue}_{2017}) / 9 \text{ years}$$

Yearly revenue growth is in units of Year 2000 US dollars. Creation of a schedule of revenues requires subtracting or adding the growth increment to Year 2017 revenue – subtracting for years prior to 2017 and adding for years after.

Combination projects us the same method, except that an additional reference point for Year 2000 provides a way to estimate toll revenues collected on the unimproved facilities during project construction. Year 2000 demand estimates do not include any project improvements, but Year 2017 and 2026 demand estimates include project improvements. The additional reference point provides two growth increments:

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42 Based on diurnal travel data from "Hampton Roads Crossing Study-Compendium of Technical Traffic Information", July 1996

$$Growth_{2000\text{-}2017} = (Revenue_{2017} – Revenue_{2000}) / 17 \text{ years}$$

$$Growth_{2017\text{-}2026} = (Revenue_{2026} – Revenue_{2017}) / 9 \text{ years}$$

Creation of a schedule of revenues for combination projects proceeds in a way similar to the stand-alone projects. First, subtract $Growth_{2000\text{-}2017}$ from Year 2017 revenue for years prior to the opening year. Then subtract $Growth_{2017\text{-}2026}$ from Year 2017 revenue for year prior to 2017, but after opening. Next, add $Growth_{2017\text{-}2026}$ to Year 2017 revenue for years 2018 through 2025 and to model year 2026 revenue for years 2027 and greater.

Derivation of Revenue Annualization Factors

The travel demand model forecasts daily travel demand and revenue, but financial analysis requires annual toll revenue. An annualization factor converts average weekday revenue (based on the travel model) to annual revenue; accounting for the expected level of weekend traffic. Since the level of weekend traffic varies by project, projects are divided into two groups according to their weekend traffic level to develop and apply a separate factor for each group.

Group 1 assumes that each weekend day earns half as much revenue as the model output for an average weekday, and thus:

For each week, 5 weekdays + (2 weekend days * 1/2 weekday/weekend day) =

6 weekdays

Annualization rate = 312.86 weekdays/year =

(6 weekdays/7days) * 365 days/year

This group includes the Midtown Tunnel / MLK Freeway Extension project, and Southeastern Parkway and Dominion Boulevard segments of Southeastern Parkway and Greenbelt Project.

Group 2 assumes that each weekend day earns two-thirds as much revenue as model output for an average weekday, and thus:

For each week, 5 weekdays + (2 weekend days * 2/3 weekday/weekend day) =

6 1/3 weekdays

Annualization rate = 330.24 weekdays/year =

[(6 1/3 weekdays) / 7 days] * 365 days/year

This group includes the Hampton Roads Third Crossing Projects (both full and Segment 1), and the Oak Grove segment of Southeastern Parkway and Greenbelt Project.

The Southeastern Parkway and Greenbelt Project includes project segments from each group, and therefore developed a composite annualization rate for the portion of model year 2026 revenue attributable to each group. The Southeastern Parkway (from I-264

to Rte 168) and Dominion Boulevard (from GW Highway to Oak Grove Connector) segments account for 63.2% of project revenue, while the Oak Grove Connector segment constitutes 36.8% of project revenue. Thus, for the project:

Annualization rate = 319.25 weekdays/year =

[(312.86 weekdays/year * 63.2%) + (330.24 weekdays/year* 36.8%)].

Appendix E

Legal, Credit, and Debt Structure Framework

Plan of Finance and Financial Model Overview

Legal, Credit and Debt Structure Framework

Rating agency guidance and industry best practices incorporate financial provisions that provide minimum legal operating parameters to limit the possibility of default and bankruptcy. Typical fiscal requirements for a toll road enterprise with outstanding bonds include:

- A toll revenue covenant with minimum required debt service coverage levels
- Minimum required funding levels of various debt service and operating reserve funds
- Minimum financial tests for the issuance of additional bonds
- An order of priority for the payment of operations, debt service and other reserves and/or returns provided by the flow of funds
- Responsibility to maintain the toll road facility at certain minimum standards
- Authority to replace an operator under certain circumstances
- Requirements to provide certain capital improvements at various stages of the project's life cycle
- Requirements to produce periodic financial statements and a budget
- Requirements to re-engage the traffic consultant if financial performance does not meet covenant levels.

Legal Framework

Toll road securitization should allow for a stable and predictable legal framework. The main points are summarized below. An important aspect of the legal framework includes the independent authority of toll road enterprises to raise tolls when revenues fall below certain levels. This authority provides toll roads with the ability to recover losses caused by inflationary pressures, under-usage or project cost overruns. Rating agencies will examine the ability to enforce contracts between the public and private sector, as well as the clear distinction of the roles and responsibilities each recognize. In the case of the public sector this may include the responsibilities between various governmental levels. Public–Private partnerships should be structured to provide protections to bondholders using the following:

- Documentation detailing the ownership structure of the project, as well as financial information of private sponsors.
- Concession agreements
- Bankruptcy and enforceability options
- Authorizing legislation governing the project
- Ability to fund improvements, increase toll charges and any required regulatory approval

- Construction liquidated damages for late completion

Toll Covenants

Typical toll roads provide a pledge to levy tolls at a ratio of net revenues (revenues less operating and maintenance expenses) to debt service of 1.25 times. Covenants above 1.50 times are generally not looked upon favorably – depending on the sensitivity of motorists to toll increases. The ability of a toll road to implement toll increases in a timely manner also plays a large role in credit ratings and market acceptance. Legal provisions concerning the ability to raise toll charges should render the toll road autonomous and describe the timely ability to increase tolls. As will be noted later in this report, there is a material difference in legal toll covenants and actual operating forecasts for debt service coverage that rating agencies demand for an investment grade credit rating for a start-up toll facility.

Additional Bonds Test

Additional Bonds Tests (ABT) that include only historical revenues tend to receive higher credit ratings than tests allowing for projected toll revenues. However, it is common for toll road projects to allow for such projected toll revenue tests. For start-up toll facility financings and smaller but expanding systems where there are no other non-toll revenues available, it is typically a necessity that a projected ABT is needed for any completion financing or major system expansion. In cases where projected revenues are used rating agencies shift their focus to management and the conservativeness used in calculating projections. The additional bonds test should closely approximate the ratio used in the toll covenant.

Debt Service Reserve Fund

A dedicated debt service reserve fund (DSRF) in order to fund any deficiency in debt service requirements is necessary for toll road financing. It is often legally allowable to substitute an insurance surety policy for a cash funded DSRF, but this option is likely not available for a start-up toll financing for reasons of credit concerns.

Credit Framework

The initial analysis of the economics used to forecast a toll roads' sustainability and ability to meet bond holders' requirements will be at the forefront of rating agency evaluations. Credit market participants will closely scrutinize all numerical projections used to develop operating pro forma analyses. Ultimately, the credit rating received is composed of several underlying projections, including: project construction, operating and maintenance expenses, and traffic and revenue forecasts. There inevitably is uncertainty in such estimates and therefore significant perceived risk by rating agencies. For an entity undertaking a new toll facility without existing toll system or outside revenue support, the emphasis on these projections is strong.

Construction Estimates

Construction risk can be a major obstacle to a new start-up in obtaining an investment-grade rating. Project construction costs should be estimated conservatively for start-up toll roads. Primary concerns include the timely completion of construction as well as completion within budget. Start-up toll roads should detail the protection to bondholders in the event of project overruns or delays through the availability of developer contributions, contractor equity, public grants, or other revenue sources that limit the amount of debt necessary for construction costs. The following concerns related to project construction should be addressed at the outset of a start-up toll road:

- Right-of-Way (ROW) and Environmental Permitting. Start-up toll roads that are planned for construction in developed areas have a greater risk of possible ROW acquisition overruns. ROW acquisition can be one of the largest cost components for new roads, and the majority of required ROW is preferably acquired prior to construction. However, in projects where this is not possible, the risk can be mitigated through phased construction offering links to connector roads at each segment. Required compensation for environmental impacts should also be included in project costs.
- Design complexity and technology. Complicated interchanges, road designs, or tunnels, if applicable, put bondholders at risk throughout the construction phase of the project. Electronic toll collection (ETC) systems that have not been tested will put bondholders at risk after construction has been completed. Though not required, the review of construction design by an independent engineer may bolster credit ratings by verifying that projected costs have been properly estimated.
- Contractor experience and contract terms. Rating agencies tend to offer higher credit ratings to start-up toll roads being constructed by established contractors. The demonstrated ability of a contractor to complete similar projects within budget and on time is a valued aspect of the evaluation of construction risk. Contractors should possess the financial strength to perform the construction requirements and financial obligations specified in the contract. Different contract terms may offer more protection against cost overruns. Depending on the complexity of the construction a fixed price or turnkey contract may be desired. Other protections, such as early completion incentives, liquidated damage provisions and construction insurance are looked upon favorably by rating agencies.
- Cash reserves. The availability of cash reserves and lines of credit can ultimately be the safeguard against cost overruns or delays in construction. These reserves should be sufficient to cover interest payments for the period of delay or fund cost overruns to ensure timely project completion.

Operations and Maintenance Estimates

Operating risks associated with the proper operation and maintenance of toll roads can also impact bondholder security. The uninterrupted operation and revenue generation of a toll road is of vital importance to long-term project viability. Normal operations and maintenance (O&M) expenses typically range from 10% to 25% of toll revenues. Aggressive marketing and use of ETC can significantly reduce O&M expenses. The proper maintenance of the asset is a primary concern to rating agencies. In the cases of inexperienced toll road operators or toll roads owned by financial investors, O&M can be contracted to experienced operators. The ability to outsource O&M expenses to a capable and experienced third-party operator can be viewed as a positive financial factor.

The importance of initial O&M estimates become greater as traffic grows and roads mature. Operating expenses tend to grow throughout the life of the road. Despite the small share of revenues attributed to O&M costs, its importance should not be underestimated as it relates to the projects total financial margin. Capital renewal and replacement costs should be carefully noted, as regular capital expenditures are necessary to maintain the peak revenue generating capability of the toll road. In addition, while maintenance expenditures are relatively predictable, the replacement cycle of ETC systems may be more difficult; therefore adequate provisions should be made for them. Scheduled capital and maintenance needs tend to be peak and valley, and should be smoothed out through appropriate capital reserve funds so that debt financing is not required.

Traffic Forecasts

The project financing of toll roads makes traffic studies a centerpiece of credit analysis. The strength and timing of a project's debt service capabilities are largely determined by the future cash flows received from anticipated traffic patterns. The need for reliable traffic studies is heightened in start-up toll roads due to the typical use of ascending debt service structures. Reliance is often placed on medium to long-term traffic growth; highlighting the need for conservatively accurate traffic forecasting. Standard and Poor's rating agency has experienced "that optimism is a consistent trend in toll road forecasting." Many times traffic forecasting errors were caused by inaccurate assumptions made when entering key inputs. Typical causes to unreliable toll road traffic studies include:

- Overestimating users' willingness to pay toll charges and toll increases
- Future economic downturns
- Development of land use along the toll road corridor, including future development being slower or less than anticipated.
- Improper estimation of time-savings derived by commuters through the use of toll roads, as well as overlooking future improvements to competing toll-free routes.
- Overestimating commercial (truck) routes

- Lower than anticipated off-peak/weekend traffic

The economic viability of start-up toll roads can be measured with the existing traffic base (or predicted market share), predictable traffic growth and affordable toll rates ensuring adequate cash flow to meet debt service and other requirements. Dependency on future development cause traffic studies to become speculative because of the uncertainty associated with the pace of development. Market share of a start-up toll road can be derived from the existing traffic base and the existence of toll-free roads and congestion. Frequency and purpose of travel also factor into traffic forecasting and can be derived from existing roads. The willingness of patrons to pay toll charges and continue use despite toll increases will ultimately depend on the time-savings associated with the toll road as well as the economic means of potential patrons.

Perhaps the most critical element to a reliable traffic forecast is the "ramp-up" period, "the process of attracting customers onto the newly built road and the development of user acceptance"[43]. An optimistic ramp-up period may prove to be too large an obstacle for a toll road to recover from. A large margin of error in the ramp-up period calculates into a deficiency in later year revenues. It is for that reason that the ramp-up period should be conservatively forecasted. Ramp-up periods tend to be shorter in projects that relieve existing traffic congestion and longer in projects that depend on future development. The overall feasibility of a toll road and the debt service coverage maintained throughout the ramp-up period can be protected through the back-loading of bond principal and slow ascending debt service. This debt structure helps to ensure that debt service obligations can be met in cases where actual revenues do not meet projections. However, this debt structure also increases the overall debt service costs significantly, and therefore diminishes the ability of a toll enterprise to accumulate capital reserves or afford additional debt. The structuring of debt service will be covered later in this report.

Ramp-up forecasting risks are mitigated in situations where the expected primary users of the project are already using other toll roads, traffic congestion or few competitive non-toll roads exist. Other factors that lessen the pressure of the ramp-up period are the strategic and well-designed placement of connections to other roads as the project is developed as well as public awareness campaigns. Ultimately, the inability to accurately predict ramp-up should be balanced through conservative assumptions.

Traffic studies should account for the economic perspective of a particular corridor. Factors used in this estimation should include: population growth, residential, commercial, and industrial development, economic competitiveness and interrelationships with adjacent economic regions. An in-depth analysis of potential future land-use patterns through information gathered from planning organizations, state and local officials, and private-land developers can be conservatively incorporated into traffic models to supplement traffic forecasts. Additional diligence in modeling traffic

43 Moody's Rating Methodology

patterns – such as the creation of peak and off-peak modeling – reduces the risk stemming from the oversimplification of assumptions, as well as providing for greater precision in complex projects. Once base case forecasts have been established sensitivity analyses that calculate the tolerable levels of differences in assumptions will result in higher credit ratings. Major rating agencies will test base case forecasts independently, but view sensitivity tests created ahead of time as positive rating factors. Typically, rating agencies test for delayed revenues and decreases in revenues ranging from 25%-50%.

Debt Structure Framework

Debt structuring for project operating revenue bonds, in particular toll revenue bonds is often far different from typical tax-backed governmental debt structures. The schedule of principal and interest payments will reflect the degree of senior and subordinate debt, some level of capitalized interest during and after the expected construction period, and an expected ramp-up period for projected toll revenues.

Ascending Debt Service

The "back-loading" of principal is often necessary to enhance the operating success of a start-up toll road project. As start-up toll road revenues increase over time larger payments of principal and interest can be made. The back loading of principal has two effects on toll road projects: While back loading of debt results in higher interest rates and lower ratings, it preserves financial flexibility during the initial years of operations. "A typical back-loaded debt service schedule has developed in the U.S. for start-up toll road projects that require substantial new development to support sizable annual debt service payments."[44]

Capital Appreciation and Current Interest Bonds

Typical start-up toll road revenue financings are structured with a mix of capital appreciation bonds and current interest bonds. Capital Appreciation Bonds (CAB), will be issued during the construction and ramp-up periods of the project. CABs will enable the debt structure to be largely back-loaded, ensuring that no payments on the bonds will be made until operating revenues have stabilized. Current Interest Bonds (CIB) will be used to level the debt service structure and help to enhance credit quality. CIBs have a lower interest cost than CABs, so their use will lower total borrowing costs. CIBs will also be structured to be heavily back-loaded, but will provide for semi-annual interest payments beginning upon their issuance. The mix of CABs and CIBs are subject to the various operating parameters of the toll facility being financing as well as credit market conditions.

Capitalized Interest

Capitalized interest is also somewhat unique to project operating revenue bonds.

44 Fitch Ratings

Basically, bond proceeds are used to pay interest on the bonds in the early years. The amount of capitalized interest is sized to cover construction and typically twelve months beyond the construction completion date to guard against a delay in project opening to revenue generating traffic. This study assumes a bond funded capitalized interest fund will be incorporated in any start-up toll road financing. Debt amortization is deferred until after the capitalized interest period, at a minimum.

Debt Service Reserve Fund (DSRF)

A debt service reserve fund will be included at the onset of any toll road bond financing. Typically DSRFs cover one-year of debt service requirements. Typical funding of the DSRF occurs in three ways: (1) Bond proceeds, (2) Incrementally from bond proceeds and system revenues over a pre-determined period (traditionally five years), (3) Surety bond or letter of credit. The amount of a DSRF that can be funded from bond proceeds is limited by Treasury regulations. In order to meet credit market requirements, especially for toll road financings with ascending annual debt service, the trust indenture might incorporate a requirement to fund up the DSRF from available excess toll revenues over time.

Debt Service Coverage

Typically, projected debt service coverage (as opposed to the toll rate covenant and additional bonds test legal requirements) on start-up toll roads should reach a minimum level of 2.0 times for senior lien debt and 1.5 times for junior lien debt. This study assumes debt service coverage on HRPDC's toll road bonds of 2.0 times projected net operating revenues (total toll revenues less operating and maintenance expenses) and that some form of subordinate debt – preferably governmental loans or developer/contractor debt – making the effective coverage "1.25". While this may imply that revenues are left un-leveraged for construction, typically the coverage cash flow is needed to fund debt and operating reserves, extra-ordinary maintenance and replacement capital needs.

Governmental Assistance

The inclusion of equity from government funds reduces the need to issue senior project debt. Obviously, Federal or state grants are the most effective form of government participation. Federal funding amounts are typically used for the initial design and engineering costs and initial construction costs. State and/or local dedicated non-toll revenues can also be extremely helpful in supporting any toll revenue debt financing plans. Many toll road financings also have pledged gas taxes, sales tax, registration fees, or some similar transportation related revenue that is not dependent upon toll facility traffic and operation.

Other governmental assistance can come in the form of subordinate debt or loans, environmental mitigation banks, and non-competition clauses. This Study will concentrate on governmental loan programs. Below are three examples of loan programs that would be applicable to this study.

Transportation Infrastructure and Finance Innovation Act (TIFIA)

The TIFIA program provides secured loans, loan guarantees, and lines of credit from the Federal government for surface transportation infrastructure projects of national or regional significance. Eligibility extends to any highway, transit or railroad project in excess of $50 million, and can include intermodal facilities, border crossing infrastructure, expansion of multi-State highway trade corridors, and other investments with regional and national benefits. The program leverages Federal funds by requiring private sector participation in project financing.

A total of $780 million of contract authority is provided to pay the estimated cost to the Federal government of providing credit assistance under TIFIA. The contract authority can support annual credit assistance of up to $2.6 billion. Repayment of the Federal credit instruments is required (on a subordinated basis) to come from tolls, user fees, or other dedicated revenue sources.

In order to be eligible for the program projects must meet certain requirements for funding, specifically:

- Any highway or transit project eligible for funding under 23 U.S.C. or 49 U.S.C. 53 is eligible for TIFIA. Other eligible projects may include international bridges; intercity rail or bus projects; and freight rail projects. SAFETEA expands the eligibility of freight rail projects to be consistent with the proposed Freight Transportation Gateways program (section 1205).
- Projects must meet the applicable Federal grant funding rules, including planning, right-of-way acquisition, competitive procurement and Buy America requirements. Total eligible project costs must be at least $50 million. SAFETEA reduces this threshold from the current level of $100 million. Projects that principally involve the installation of an intelligent transportation system (ITS) must meet a $30 million threshold.

The Secretary selects projects to receive TIFIA credit assistance through a competitive application process administered by the TIFIA Joint Program Office. TIFIA projects are selected on the basis of eight statutory criteria, including national or regional significance; creditworthiness; private participation; accelerating project schedules; the use of new technologies; the use of budget authority; environmental stewardship; and the reduction of Federal grant assistance.

The TIFIA credit instrument may be subordinate to other senior debt obligations on the project. Senior obligations must meet several requirements:

- The senior debt must receive an investment grade rating.
- The senior debt must be secured by the same revenue stream as the TIFIA credit instrument.
- The total amount of the senior project obligations must equal or exceed the total amount of the TIFIA instrument. This requirement is added under SAFETEA.

The amount of the Federal loan or line of credit may not exceed 33 percent of the

anticipated eligible project costs.

VDOT Toll Facilities Revolving Account

The Toll Facilities Revolving Account ("TFRA") is a separate subaccount within the Transportation Trust Fund. TFRA was created under §33.1-23.03:4 of the Code of Virginia to pay or finance all or a part of toll facilities constructed under the provisions of Title 33.1. The 1986 Special Session II of the General Assembly, the Commission on Transportation in the 21st Century, recommended the establishment of TFRA for a method to finance or refinance existing and potential toll facilities. On July 1, 1987, TFRA was created and in 1995 the statute was amended to clarify the intent that the funds allocated from TFRA for a planned or operating toll facility shall be considered as an advance of funding for which TFRA shall be reimbursed. TFRA is funded through interest earnings on the Construction Funds and Highway Maintenance and Operating Funds of various projects throughout the state.

Toll projects seeking to qualify for funding through TFRA must first be included as part of the Commonwealth Transportation Board's (CTB) Six-Year Improvement Program. The Six-Year Improvement Program allocates funds for transportation projects proposed for construction, development or study in the next six fiscal years and is updated annually. After a project is included in the Six-Year Improvement Program the CTB prioritizes projects based on several criteria, including: the ability of a project to reimburse the toll facilities revolving account in the future – "Funds allocated from the TFRA shall be considered as an advance of funding for which the Account shall be reimbursed," a reasonable term on the loan, the ability to repay the Board it's portion of any costs incurred in accordance with a comprehensive agreement with respect to a transportation facility, and that the operator's return on its investment is limited to a reasonable rate.

State Infrastructure Bank

Virginia's State Infrastructure Bank (SIB) was authorized in September 1996 with the signing of a Cooperative Agreement between the Federal Highway Administration (FHWA) and the Virginia Department of Transportation (VDOT) under provisions of Virginia's Public-Private Transportation Act (PPTA) of 1995, Section 350 of the National Highway System (NHS) Designation Act of 1995 and Section 33.1-23.03:4 of the Code of Virginia.

The purpose of the SIB was to make alternative loan-based financing available to eligible public and private entities for transportation projects. Virginia's SIB was capitalized with $18 million of federal funds and $4.5 million of state matching funds provided from the Toll Facilities Revolving Account in March 1998. The funds are designated as revolving funds with repayments to be used to make loans for additional projects.

Flow of Funds

A well-defined flow of funds, or priority of toll revenues, within the enterprise structure is important for toll road bond issuance and financial stability. A dedicated bond proceeds

account(s) held by the bond trustee and an appropriate cash flow priority are viewed as necessary tools to ensure that the toll road cash flow is directed in accordance with rating requirements and prudent financial management. Debt service payments are typically subordinated to operational and routine maintenance expenses. Cash flow is then usually applied in the order of interest and principal on bonds, and next filling any DSRF reserve requirements. Excess cash flow is then applied to any subordinate debt and various reserve requirements.

It is common for tax-backed revenue bond flow of funds to allow revenues after debt service and DSRF to "escape" the trust indenture and be used for any lawful purpose. For toll road enterprise financings, however, it is important to have a "closed" flow if funds where all toll revenues stay in the toll enterprise.

Plan of Finance and Financial Model Overview

This study uses a proprietary toll facility financing model. This model is integrated, combining Microsoft excel software and DBC Finance ("DBC") software. The toll revenue model incorporates data input, including construction schedules and revenue sources from Microsoft EXCEL and operates simultaneously with DBC, the industry standard for municipal bond structuring, to structure bond issuances.

Using toll revenues for each stand-alone project, and defined project combination scenarios and packages; operations expenses were subtracted from toll revenues resulting in a net revenue pledge used as security for toll revenue bonds. As additional (non-tax) funding sources were identified for specific projects, they were applied to either increase bonding capacity, offset construction requirements or both.

This study assumes the following priority of funds for the toll-financing model:

- Pledged Revenues is equal to Gross Revenues less O&M expenses, i.e. net operating revenues. Gross Revenues include the interest earnings from the O&M Reserve Fund, Renewal & Replacement Fund, and General Reserve Fund.
- Pledged Revenues cover Net Debt Service, which is gross annual debt service less capitalized interest and less interest earnings on the debt service accounts.
- DSRF is next in line from Pledged Revenues. The DSRF deposit that can be legally funded from bond proceeds will be limited the maximum annual debt service ("MADS") for a five-year period. Given the ascending debt service structure, the DSRF requirement will not be fully funded from bond proceeds and will require future deposit from toll revenues. The DSRF is restricted in use to the payment of bond debt service.
- The next priority is an operations and maintenance reserve fund ("O&M Reserve Fund") to be funded from excess toll revenues at two months worth of O&M expenditures with the initial fund up from the first available revenues. The O&M Reserve Fund should come behind the DSRF fund in the flow of funds. O&M

Reserve Fund balances would be restricted in use to O&M expenditures in the event annual cash flow was insufficient for such purposes.

- A renewal & replacement fund ("R&R Fund") should be maintained at an adequate balance from toll revenues. The R&R Fund should come behind the DSRF and the O&M Reserve in the flow of funds priority. R&R Fund balances would be restricted in use to non-recurring maintenance expenditures as well as O&M expenditures and debt service on the bonds in the event annual cash flow was insufficient for such purposes.
- A loan repayment account should be established next within the flow of funds for the repayment of government loans and developer/contractor notes. Interest on unpaid balances would accrue at 3% per annum compounded semi-annually beginning when surplus toll revenues exist. The loan repayments come after the R&R Fund.
- Finally, excess revenues flow to a general reserve fund.

The net revenue pledge, additional funding sources and construction requirements were entered into DBC to structure bond financing according to an array of inputs detailed below.

Composition

Toll revenue bonds were structured using a combination of CIBs and CABs. Because CABs do not pay interest periodically, they are a common feature of start-up toll facility financings. For the same reason, CABs also have a higher cost of borrowing associated with them and as such are only issued as necessary to complete a financing.

Interest Rates

Current Municipal Market interest rates were assumed for bond transactions. A credit spread was applied to interest rates in order to simulate actual market pricing. It is expected that stand-alone toll revenue bonds to be credit rated "BBB" at best and therefore such bonds would carry a higher interest rate.

Debt Service Structure

Toll revenue bonds were structured for ascending debt service, i.e. debt service increases annually as toll revenues increase, maintaining a 2.0x coverage ratio. Toll revenue bonds can be structured for ascending debt service because of the ability to raise toll rates in the future if revenues are lower than projected.

Coverage

Toll revenue bonds were structured to maintain 2.0 times projected coverage (net toll

revenues divided by debt service) over ascending annual debt service, as recommended by rating agencies in order to achieve investment grade. Subordinate toll revenue bonds and loans were structured to maintain 1.25 times projected coverage. This coverage is reasonable for any project or combination scenario when combined with innovative financing techniques and PPTA.

Capitalized Interest

Due to the delay in revenues and upfront construction costs associated with start-up toll facilities, many are required to capitalize interest payments until the toll facility is opened. It is further recommended that interest be capitalized through the first six to twelve months of construction to provide for potential construction delays or a longer than anticipated ramp-up period.

Other Costs

Cost of Issuance, Underwriters Discount and Bond Insurance were applied to each bond issue. Cost of Issuance was assumed to be $250,000 per transaction and bond insurance was assumed to be equal to 40 basis points of total debt service. Underwriter's Discount is calculated on a per bond basis (discount/$1,000) and differs by both the type of bond and the security backing. $6.50 and $7.25 were applied to toll revenue CIBs and toll revenue CABs, respectively. These costs are normal costs associated with the issuance of municipal bonds, and closely parallel the costs of similar transactions.

Based on experience with start-up toll facility financings the overall plan of finance was structured in accordance with market standards. Given a market acceptable traffic & revenue report and consulting engineer's report, all of the financing assumptions utilized to structure the plan of finance are acceptable to rating agencies and credit enhancers and are sufficient to achieve investment grade credit ratings of "BBB" or better. DBC was incorporated to structure bond financings according to construction requirements and available revenue sources. The financial model calculates long-term debt service schedules, applicable debt service coverage requirements, and excess revenues remaining after debt service payment.

Two separate financing structures were provided to the Metropolitan Planning Organization in September and October 2004, each with an alternate plan of finance including the attributes explained previously. The initial analysis anticipated utilizing toll revenue bonds to finance stand-alone projects. The second analysis incorporated tolling existing roadways in order to generate upfront financing sources, thus limiting the additional cost of capitalizing interest. Table 3.1-1 below compares the different structures.

Plans of finance were structured differently due to the introduction of additional and alternative revenue sources, above new toll revenues, as the study progressed. For instance, the first analysis attempted to finance stand-alone projects solely using toll revenues produced by those facilities. As such, interest was capitalized through the construction phase. A greater amount of CABs were also issued in order to maximize

financing proceeds. In comparison, the second analysis, which included revenues produced by tolling existing facilities, did not require capitalized interest or the issuance of as many CABs. Each plan of finance was structured to achieve investment grade credit ratings.

Table E-1 Debt Financing Structures – Toll Revenue Bonds

	Stand Alone Toll Facilities	Combination Toll Facilities
CIBS	yes	Yes
CABS	yes	Yes
Coverage	2.00	1.75
Structure	Ascending	Ascending
Capitaled Interest	Thru Construction Period	N/A
Bond Insurance	40 bps	40 bps
Underwriter's Discount	$7.50/$6.25 ($/1,000)	$7.50/$6.25 ($/1,000)
Costs of Issuance	$250,000	$250,000
Multiple Issuance	No	Yes

Capitaled interest - interest that is included "upfront" in the financing, or capitalized, therefore not paid from annual revenues (prepaid through bond proceeds)
Underwriter's Discount – this is the bankers per bond fee associated with selling the bonds
Costs of Issuance – normal costs associated with selling bonds (fees for attorney, financial advisor, rating agencies)

Appendix F

Risk Analysis – Methods and Parameters

Simple sensitivity analysis and Monte Carlo simulation was used to gauge financial risk associated with deterministic estimates of financial feasibility. This appendix describes the methodology employed, the input parameters subject to risk, and distributions of values used for those parameters.

Sensitivity testing is the most common method employed. In sensitivity testing, an input or combination of inputs to the project financial model are varied and the resulting impact on the finances is measured. In this way, that impact can be isolated as a way to consider the project under different conditions, based on input parameters that would most likely vary..

Monte Carlo simulation is another method for assessing the project risk. Monte Carlo simulation is a powerful tool used for measuring and preparing for uncertainty by allowing us to consider many possible outcomes rather than a single solution, and it provides for the presentation of results as a range of outcomes rather than as a single result. Applying Monte Carlo simulation to our financial analysis requires input of a distribution of likely values rather than use a single input value for various financial elements. Monte Carlos simulation then generates a number of scenarios that are a combination of randomly selected values for each input (based upon the input distribution).

Monte Carlo Simulation Model

We also executed Monte Carlo simulation to perform a comprehensive risk analysis. Other sections of the report describe the creation of the revenue schedule and the development of the financial model. To perform Monte Carlo simulation, we needed to integrate these elements together so that the impact of changes to common inputs can be measured together.

As discussed in Appendix “E”, DBC Finance is used to calculate the bonding capacity used in the financial model. This analysis used the “Crystal Ball” add-in to Microsoft EXCEL to execute Monte Carlo simulation, and needed the entire financial model, including the bonding capacity, native to EXCEL. This required emulating, in EXCEL the logic embedded in DBC Finance. Since some of this logic could not be exactly replicated in EXCEL, some simplifications to the EXCEL financial model were necessary, with the objective of closely replicating the values determined by the DBC-based financial model. A pivot methodology that applied the risk assessment from the EXCEL-based model onto the DBC-based financial model results was used to account for discrepancies in the two models. The result was an EXCEL model that combined the basic revenue and cost information so that each change in input values would be reflected in the revenue schedule, cost schedule, and ultimately financial feasibility determination.

The assessment measures derived from the risk analysis are the mean, mean plus one standard deviation, mean less one standard deviation, maximum, and minimum funding deficit.

Project Specific Parameters

The first step of the analysis was to select those input parameters to the financial model subject to risk and specify their distribution of likely values. The following input parameters were identified that could have a significant impact on project financial feasibility:

- Toll Revenue – daily revenue forecast generated by the travel demand model
- Annualization Factor – the factor used to convert from daily to yearly revenue
- Ramp-up Factor – the factor used to discount (amplify) the toll revenue immediately after project opening
- Inflation Rate – the rate used to inflate construction costs and toll revenue
- Operations and Maintenance Percentage – percentage of toll revenue used to cover operations and maintenance
- Construction Start Year – year of construction beginning
- Interest Rate – the interest rate applied to bonds and loans
- Preliminary Design and Engineering Costs – percentage of total project cost to be accrued during Preliminary Design and Engineering
- Construction Cost – total project construction cost
- Construction Period Length – duration of project construction

Some of these input parameters are fundamental to the financial model and the assumptions made regarding the value of each could significantly impact the financial analysis. A risk analysis was completed for each project or scenario by specifying a frequency distribution of input parameter values for the Monte Carlo simulation; customized for each project or scenario. Input parameter distributions were assumed to be triangular with the initial value (that used during the deterministic analysis) as the most frequent. Described below describe the upper and lower parameter limits used for each of the individual risk analyses.

Hampton Roads Third Crossing - Segment 1

Table F-1 shows the input distribution limits of the parameters specified for the Hampton Roads Third Crossing Segment 1 (HRX S1). Toll revenue varies from 70% to 160% of the travel demand model's forecast. The distance between the upper limit and initial value is greater than that of the lower limit and initial value. These limits reflect an opinion that despite efforts to adapt the Hampton Roads regional travel demand model

As the discussion of the revenue schedule development describes (Chapter 2), the ramp-up factor of -30% for the HRX S1 actually represents a ramp-down period (hence the negative ramp-up value) as travelers change their driving patterns in response to the new tolls. This parameter has distribution limits from double the initial value to no impact.

The inflation rate is another parameter specified to have a greater share of the distribution on the lower side of the initial value. The lower limit is based on the *Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004*, which contains the forecasts from many leading economists for a variety of measures including the Consumer Price Index. This value is substantially lower than the initial value, representing the current low interest rate situation. The upper range is not extended much higher than the initial value because the inflation rate to is not expected to increase that much.

Based on the beliefs of the HRPDC, the upper limit of the Operations & Maintenance factor was restrained from increasing much over the initial value, as they believed that costs much greater than the initial 30% would be covered as a VDOT expense.

At the time of the analysis (Fall 2004) it was highly unlikely that construction would begin sooner than the scheduled start year of 2005 – thus, only the upper limit was adjusted by 1 year to 2006.

The remaining adjustments follow a symmetric approach. The interest rate distribution limits were set at +/- 25% of the initial value. Similarly, the Preliminary Design & Engineering cost limits were set at +/-1% of the initial value. Construction cost input distribution limits are +/-10% of the initial value, and the construction period length distribution limits are +/- 1 year from the initial value.

Hampton Roads Third Crossing

Table F-2 contains the parameter distribution limits for the full Hampton Roads Third Crossing. These limits are very similar to the ones used for Segment 1 alone. The most significant difference is in the construction start year, where the distribution limits are specified as up and down a year from the initial value. Other differences are in the construction cost and construction length, but we apply the same logic to calculate the parameter distribution limits as with Segment 1.

Midtown Tunnel and MLK Freeway Extension

Table F-3 contains the parameter distribution limits for the Midtown Tunnel and MLK Freeway Extension project. Most logic used to assign the parameter distribution limits are the same as for the Hampton Roads Third Crossing projects. The differences in the initial values of the annualization factor and ramp-up factors are discussed in Section 2.2. Due to the differences in the initial values, the limits also vary.

One aspect of this project that is different from the previous projects is that the revenue is scheduled to begin mid-year. The financial risk model is developed to use full year data, and this analysis implemented rounding logic in order to maintain a full year start.

Thus, this feature caused the revenue to begin a half-year later for this project.

US Route 460

Table F-4 contains the parameter distribution limits for the US Route 460. Most logic used to assign the distribution limits are the same as for the previous projects. The limits relating to the annualization and ramp-up factors are different for the reasons described in Section 2.2. As previously described, the financial risk model uses full years and had the effect of shifting the used construction start year forward half a year.

Southeastern Parkway and Greenbelt

Table F-5 shows the input distribution limits used in the Monte Carlos simulation analysis of the Southeastern Parkway and Greenbelt project. Again, many of the distributions are the same as those described for previous projects, with the differences stemming from the initial construction values (cost and length) and the values used to create the revenue schedule. Beyond these differences, we apply the same logic to create the distributions.

Project Scenario 1

Project Scenario 1 is an version of the Hampton Roads Third Crossing project, and thus the Monte Carlo simulation input distributions, which are displayed in Table F-6, are virtually the same. The one difference is the initial value for the Operation and Maintenance Percentage. Project Scenario analysis assumed that only 15% of revenues would be used towards covering toll operations and administration, and that toll revenue would no longer be used towards covering facility maintenance. Thus, distribution limits of 10% to 20% were used for this parameter.

Project Scenario 2

Table F-6 presents the parameter distribution limits for Project Scenario 2. Many of these values are identical to those used to analyze Project Scenario 1. The only difference is the initial value, and thus limits for the construction cost parameter.

Project Scenario 3

The deterministic feasibility analysis of Project Scenario 3 determined that only 37% of the toll revenue was necessary to finance the project. Since the project is funded with such abundance, an analysis of financial risk was not necessary.

Table F-1 Input Parameter Distributions – HRX, Segment 1

Parameter	Initial Value	Lower Limit	Upper Limit	Logic
Toll Revenue	1.0	0.7	1.6	Despite model adaptations, most likely estimating low.
Annualization Factor	330	275	350	Little upper movement possibilities
Ramp-up Factor	-30%	-60%	0%	Double to no impact
Inflation Rate	3.89%	2.5	4.5	Lower limit from Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004
Operations & Maintenance Percentage	30%	15%	35%	Restrain upper limit since assume VDOT would pick up higher costs
Construction Start Year	2005	2005	2006	Up 1 year
Interest Rate	5.85%	4.39%	7.31%	Down / up 25%
Prelim. Design & Engineering	3%	2%	4%	Down / up 1%-pt
Construction Cost	1,795,000,000	1,615,500,000	1,974,500,000	Down / up 10%
Construction Length	3	2	4	Down / up 1 year

Table F- 2 Input Parameter Distributions - Hampton Roads Third Crossing

Parameter	Initial Value	Lower Limit	Upper Limit	Logic
Toll Revenue Factor	1.0	0.7	1.6	Despite model adaptations, most likely estimating low.
Annualization Factor	330	275	350	Little upper movement possibilities
Ramp-up Factor	-30%	-60%	0%	Double to no impact
Inflation Rate	3.89%	2.5	4.5	Lower limit from Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004;
Operations & Maintenance Percentage	30%	15%	35%	Restrain upper limit since assume VDOT would pick up higher costs
Construction Start Year	2006	2005	2007	Down / up 1 year
Interest Rate	5.85%	4.39%	7.31%	Down / up 25%
Prelim Design & Engineering	3%	2%	4%	Down / up 1%-pt
Construction Cost	2,700,000,000	2,430,000,000	2,970,000,000	Down / up 10%
Construction Length	11	8	14	Down / up 25%

Table F-3 Input Parameter Distributions - Midtown Tunnel and MLK Freeway

Parameter	Initial Value	Lower Limit	Upper Limit	Logic
Toll Revenue Factor	1.0	0.7	1.6	Despite model adaptations, most likely estimating low.
Annualization Factor	313	270	335	Little upper movement possibilities
Year 1 Ramp-up Factor	21.3%	0%	42.6%	Double to no impact
Year 2 Ramp-up Factor	14.2%	0%	28.5%	Double to no impact
Inflation Rate	3.89%	2.5	4.5	Lower limit from Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004;
Operations & Maintenance Factor	30%	15%	35%	Restrain upper limit since assume VDOT would pick up higher costs
Construction Start Year	2009	2008	2010	Down / up 1 year
Interest Rate	5.85%	4.39%	7.31%	Down / up 25%
Prelim Design & Engineering	3%	2%	4%	Down / up 1%-pt
Construction Cost	421,000,000	378,900,000	463,100,000	Down / up 10%
Construction Length	7	5	8	Down / up 25%

Table F-4 Input Parameter Distributions - US Route 460

Parameter	Initial Value	Lower Limit	Upper Limit	Logic
Toll Revenue Factor	1.0	0.7	1.6	Despite model adaptations, most likely estimating low.
Annualization Factor	313	270	335	Little upper movement possibilities
Year 1 Ramp-up Factor	85.7%	0%	171.4%	Double to no impact
Year 2 Ramp-up Factor	57.2%	0%	114.4%	Double to no impact
Inflation Rate	3.89%	2.5	4.5	Lower limit from Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004;
Operations & Maintenance Percentage	30%	15%	35%	Restrain upper limit since assume VDOT would pick up higher costs
Construction Start Year	2010	2009	2011	Down / up 1 year
Interest Rate	5.85%	4.39%	7.31%	Down / up 25%
Prelim Design & Engineering	3%	2%	4%	Down / up 1%-pt
Construction Cost	894,000,000	804,600,000	983,400,000	Down / up 10%
Construction Length	8	6	10	Down / up 25%

Table F-5 Input Parameter Distributions - Southeastern Parkway and Greenbelt

Parameter	Initial Value	Lower Limit	Upper Limit	Logic
Toll Revenue Factor	1.0	0.7	1.6	Despite model adaptations, most likely estimating low.
Annualization Factor	319	270	340	Little upper movement possibilities
Year 1 Ramp-up Factor	85.7%	0%	171.4%	Double to no impact
Year 2 Ramp-up Factor	57.2%	0%	114.4%	Double to no impact
Inflation Rate	3.89%	2.5	4.5	Lower limit from Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004;
Operations & Maintenance Percentage	30%	15%	35%	Restrain upper limit since assume VDOT would pick up higher costs
Construction Start Year	2010	2009	2011	Down / up 1 year
Interest Rate	5.85%	4.39%	7.31%	Down / up 25%
Prelim Design & Engineering	3%	2%	4%	Down / up 1%-pt
Construction Cost	657,314,964	591,583,467	723,046,460	Down / up 10%
Construction Length	8	6	9	Down / up 25%

Table F-6 Input Parameter Distributions - Project Scenario 1

Parameter	Initial Value	Lower Limit	Upper Limit	Logic
Toll Revenue Factor	1.0	0.7	1.6	Despite model adaptations, most likely estimating low.
Annualization Factor	330	275	350	Little upper movement possibilities
Ramp-up Factor	-30%	-60%	0%	Double to no impact
Inflation Rate	3.89%	2.5	4.5	Lower limit from Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004;
Operations & Maintenance Percentage	15%	10%	20%	Restrain upper limit since assume VDOT would pick up higher costs
Construction Start Year	2006	2005	2007	Down / up 1 year
Interest Rate	5.85%	4.39%	7.31%	Down / up 25%
Prelim Design & Engineering	3%	2%	4%	Down / up 1%-pt
Construction Cost	2,700,000,000	2,430,000,000	2,970,000,000	Down / up 10%
Construction Length	11	8	14	Down / up 25%

Table F-7 Input Parameter Distributions - Project Scenario 2

Parameter	Initial Value	Lower Limit	Upper Limit	Logic
Toll Revenue Factor	1.0	0.7	1.6	Despite model adaptations, most likely estimating low.
Annualization Factor	330	275	350	Little upper movement possibilities
Ramp-up Factor	-30%	-60%	0%	Double to no impact
Inflation Rate	3.89%	2.5	4.5	Lower limit from Blue Chip Economic Indicators Long-Range CPI forecast Mar 10, 2004;
Operations & Maintenance Factor	15%	10%	20%	Restrain upper limit since assume VDOT would pick up higher costs
Construction Start Year	2006	2005	2007	Down / up 1 year
Interest Rate	5.85%	4.39%	7.31%	Down / up 25%
Prelim Design & Engineering	3%	2%	4%	Down / up 1%-pt
Construction Cost	1,200,000,000	1,080,000,000	1,320,000,000	Down / up 10%
Construction Length	11	8	14	Down / up 25%

Appendix G

Traffic Impacts – Level-of-Service

Note: This appendix is oversized (11”x17”) and bound under separate cover.

Appendix H

Traffic Impacts – Travel Patterns

Note: This appendix is oversized (11”x17”) and bound under separate cover.

Appendix I

Index of Acronyms and Abbreviations

ABT – Additional Bonds Test

ADT – Average Daily Traffic

BBB – “BBB”; minimum investment grade bond rating

CAB – Capital Appreciation Bonds

CIB – Current Interest Bonds

CTB – Commonwealth Transportation Board

DBC Finance – general bond structuring software tool (www.dbc.biz/)

DSRF – Debt Services Reserve Fund

ETC – Electronic Toll Collection

FHWA – Federal Highway Administration

HBO – Home Based Other

HBW – Home Based Work

HCS – Highway Capacity Software

HOV – High Occupancy Vehicle

HRBT – Hampton Roads Bridge Tunnel

HRPDC – Hampton Roads Planning District Commission

HRX – Hampton Roads Crossing

JRB – James River Bridge

LOS – Level of Service

MADS – Maximum Annual Debt Service

MLK – Martin Luther King

MMMBT – Monitor Merrimac Bridge Tunnel

NHB – Non-Home Based

NHS – National Highway System

O&M – Operations and Maintenance

OD- Origin/Destination

ORT – Open Road Tolling

P/D&E – Preliminary Design and Engineering

PHF – Peak Hour Factor

PPTA – Public-Private Transportation Act

ROW – Right-of-Way

RSTP – Regional Surface Transportation Program

SAFETEA – Safe, Accountable, Flexible and Efficient Transportation Equity Act

SIB – Virginia State Infrastructure Bank

SOV – Single Occupant Vehicle

SP&G – Southeastern Parkway & Greenbelt

TFRA – Toll Facilities Revolving Account

TIFIA – Transportation Infrastructure and Finance Innovation Act

VDOT – Virginia Department of Transportation

VHT – Vehicle Hours Traveled

VMT – Vehicle Miles Traveled

VOC – Vehicle Operating Costs

VOT – Value of Time

YOE – Year of Expenditure Cost

TOLL FEASIBILITY STUDY

Traffic Impacts Appendices

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Toll Feasibility Study
Appendix G
Revenue Optimized Tolls – Level-of-Service

Note: Definition of Project Scenarios:

Features	Project Scenario #1	Project Scenario #2	Project Scenario #3
Projects	• HRX	• Improved HRBT (1)	• Midtown & MLK
Existing/Unimproved, Tolled Roadways	• MMMBT • JRB • HRBT	• MMMBT • JRB • HRBT	• Downtown Tunnel

(1) Hampton Roads Crossing Study, Alternative #1
MMMBT – Monitor Merrimac Bridge Tunnel
JRB – James River Bridge
HRBT – Hampton Roads Bridge Tunnel

The LOS analyses were performed using the Highway Capacity Software (HCS 2000 4.1e) based on the Highway Capacity Manual. Four (4) HCS modules were used for the various analyses as follows:

- Directional Two Lane Highway Segment Analysis (Two Lane);
- Arterials Planning Analysis (Arterials);
- Multilane Highways Planning Analysis (Multilane); and
- Basic Freeway Segments Operational Analysis Planning (Freeway)

Typical roadway, network and traffic flow characteristics are required as inputs for the various analyses. These include volume, peak hour factor (PHF), K factor, D factor, saturation flow rate, free flow speed, truck percentages, percent no passing zones, number of access locations, number of signals, and basic signal timing parameters. The majority of this data was derived from various studies conducted by the Hampton Roads Planning District Commission (HRPDC) as regional planning documents or on behalf of the local governments. These studies included:

1. *Norfolk Level of Service Study* (January 2000),
2. *Newport News Level of Service Study* (April 2001),
3. *Chesapeake Level of Service Study* (June 2003),
4. *2026 Regional Transportation Plan Technical Document* (July 2004), and
5. *2026 Regional Transportation Plan Technical Document Appendices* (July 2004).

This information was supplemented by data from other studies conducted in Virginia Beach including Elbow Road Phase IIA, Elbow Road Phase II, I-264/Lynnhaven Parkway/Great Neck Road Interchange Improvements and the Virginia Beach Convention Center. Considerable data collection efforts were undertaken as part of these studies and the data was used to derive the necessary data for LOS evaluation of segments in Virginia Beach. In addition, field verification of data was necessary for segments in Virginia Beach and along Route 460 to satisfy data requirements. Analysis results are shown in the following tables and figures.

Table G-1 Year 2026 Level-of-Service

			No Build						Hampton Roads Crossing - Full						
Planning Analysis		**Segments**	**ADT**	**AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])**	**AM Peak Hour Calc. Volume**	**AM Peak Hour LOS (HCS)**	**PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])**	**PM Peak Hour Calc. Volume**	**PM Peak Hour LOS (HCS)**	**ADT**	**AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])**	**AM Peak Hour Calc. Volume**	**AM Peak Hour LOS (HCS)**	**PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])**	**PM Peak Hour Calc. Volume**	**PM Peak Hour LOS (HCS)**
	A	*Hampton Roads Beltway (17 Segments)*														
Freeway	A1	I-64, I-664 to Armistead Ave	132,900				38.1	12,000	E	131,700				36.8	11,900	E
Freeway	A2	I-64, Armistead Ave to Hampton Roads Bridge Tunnel	109,700				27.2	9,900	D	113,400				28.5	10,200	D
Freeway	A3	Hampton Roads Bridge Tunnel	101,000				*	9,100	F	101,800				*	9,200	F
Freeway	A4	I-64, Hampton Roads Bridge Tunnel to I-564	99,700				*	9,000	F	96,800				*	8,700	F
Freeway	A5	I-64, I-564 to Chesapeake Blvd	161,300				*	14,500	F	163,100				*	14,700	F
Freeway	A6	I-64, Chesapeake Blvd to Northampton Blvd	181,100				*	16,300	F	172,800				*	15,600	F
Freeway	A7	I-64, Northampton Blvd to I-264	184,000				40.8	16,600	E	176,900				37.5	15,900	E
Freeway	A8	I-64, I-264 to Indian River Rd	163,200				32.0	14,700	D	161,000				31.4	14,500	D
Freeway	A9	I-64, Indian River Rd to Greenbrier Pkwy	147,000				27.4	13,200	D	148,700				27.8	13,400	D
Freeway	A10	I-64, Greenbrier Pkwy to I-464	127,300				23.0	11,500	C	131,000				23.8	11,800	C
Freeway	A11	I-64, I-464 to I-264	92,000				42.1	8,300	E	82,800				32.9	7,400	D
Freeway	A12	I-664, I-264 to Route 58	129,700				23.5	11,700	C	89,800				16.3	8,100	B
Freeway	A13	I-664, Route 58 to Route 164/Western Frwy	79,800				30.9	7,200	D	34,700				12.5	3,100	B
Freeway	A14	I-664, Route 164/Western Frwy to proposed EW Conn.	65,000				23.9	5,900	C	22,000				8.0	2,000	A
Freeway	A15	I-664, proposed EW Conn. to 23rd St	82,200				32.5	7,400	D	39,900				14.5	3,600	B
Freeway	A16	I-664, 23rd St to Aberdeen Rd	77,200				29.4	6,900	D	29,000				10.5	2,600	A
Freeway	A17	I-664, Aberdeen Rd to I-64	85,600				34.9	7,700	D	41,100				15.2	3,700	B
	B	*Midtown Tunnel area (3 segments)*														
Two-Lane	B1	Midtown Tunnel	53,600						F	47,500				-		F
Freeway	B2	MLK Frwy, High St to Pinner's Point Conn.								30,800				13.2	2,800	B
Freeway	B3	Western Frwy (Route 164, Town Point Rd to MLK Frwy	74,500				28.1	6,700	D	65,400				23.7	5,900	C
	C	*Route 460 (6 segments)*														
Multi-Lane	C1	I-664 to Route 58 Bypass	84,900		6,600	D		7,100	C	77,000	-	6,000	C	-	6,500	C
Freeway	C2	Route 58 Bypass														
Multi-Lane	C3	Route 58 Bypass to Windsor														
Multi-Lane	C4	Windsor to Waverly														
Multi-Lane	C5	Waverly to Route 156														
Multi-Lane	C6	Route 156 to I-295														
	D	*Oak Grove Conn. & Dominion Blvd (4 segments)*														
Two-Lane	D1	Dominion Blvd, Route 17 to Cedar Rd	13,200		800	E		1,000	E	13,100	-	800	E	-	1,000	E
Arterial	D2	Dominion Blvd, Cedar Rd to Bainbridge Blvd	39,500	2.4	3,100	F	2.7	3,300	F	35,500	2.9	2,800	F	3.2	3,000	F
Arterial	D3	Dominion Blvd, Bainbridge Blvd to Great Bridge Blvd	30,600	6.4	2,300	F	8.2	2,400	F							
Freeway	D4	Oak Grove Conn. (from I-64 to Battlefield Blvd)	117,300				*	10,600	F	129,700				*	11,700	F
	E	*Hampton Blvd & Brambleton Ave (5 segments)*														
Arterial	E1	Brambleton Ave to 21st St	38,600	7.3	2,700	F	5.1	2,900	F	36,500	10.2	2,500	F	6.6	2,700	F
Arterial	E2	38th St to Little Creek Rd	34,800	19.1	2,300	D	18.5	2,700	D	39,400	18.6	2,600	D	17.9	3,100	D
Arterial	E3	Little Creek Rd to proposed EW Conn.	30,700	21.1	2,100	D	21.7	2,400	D	36,100	20.1	2,500	D	20.9	2,800	D
Arterial	E4	Proposed EW Conn. to Adm Taussig Blvd	32,700	17.5	2,500	D	18.4	2,500	D	34,200	17.2	2,600	D	18.2	2,600	D
Arterial	E5	Brambleton Ave, Colley Ave to Boush St	65,900	4.0	5,300	F	3.4	5,500	F	65,600	4.1	5,300	F	3.4	5,500	F
	F	*Downtown Tunnel Area (5 segments)*														
Freeway	F1	Downtown Tunnel (I-264 from Portsmouth to I-464)	120,600				*	10,900	F	110,100				*	9,900	F
Freeway	F2	Berkley Bridge (I-264 from Waterside to I-464)	123,100				28.2	11,100	D	130,800				30.0	11,800	D
Two-Lane	F3	Jordan Bridge(Poindexter from Portsmouth to I-464)	5,200						E	12,600				-		E
Arterial	F4	Effingham St, I-264 to South St	38,500	1.8	3,800	F	1.8	3,800	F	37,300	1.9	3,700	F	1.9	3,700	F
Arterial	F5	Frederick Blvd, I-264 to Turnpike Rd	46,600	2.6	4,700	F	2.6	4,700	F	49,300	2.3	4,900	F	2.3	4,900	F

			No Build						Hampton Roads Crossing - Full						
Planning Analysis		**Segments**	**ADT**	**AM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**AM Peak Hour Calc. Volume**	**AM Peak Hour LOS (HCS)**	**PM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**PM Peak Hour Calc. Volume**	**PM Peak Hour LOS (HCS)**	**ADT**	**AM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**AM Peak Hour Calc. Volume**	**AM Peak Hour LOS (HCS)**	**PM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**PM Peak Hour Calc. Volume**	**PM Peak Hour LOS (HCS)**
	G	*I-64 (on the Peninsula) (5 segments)*														
Freeway	G1	New Kent County Line to Route 30 (Exit 227)	9,600				3.5	900	A	9,600				3.5	900	A
Freeway	G2	Route 30 (Exit 220) to Croaker Rd (Exit 231)	67,700				24.7	6,100	C	68,300				25.0	6,200	C
Freeway	G3	Croaker Rd (Exit 231) to Route 199 @ Lightfoot (Exit 234)	83,900				33.6	7,600	D	84,400				34.0	7,600	D
Freeway	G4	Route 199 @ Lightfoot (Exit 234) to Camp Peary Rd (Exit 238)	77,000				29.3	6,900	D	76,900				29.2	6,900	D
Freeway	G5	Camp Peary Rd (Exit 238) to Route 199 @ Kingsmill (Exit 242)	80,100				31.1	7,200	D	81,200				31.9	7,300	D
	H	*I-264 (4 segments)*														
Freeway	H1	Witchduck Rd to Independence Blvd	222,100				*	20,000	F	223,600				*	20,100	F
Freeway	H2	Independence Blvd to Rosemont Rd	181,100				40.1	16,300	E	182,100				39.8	16,400	E
Freeway	H3	Rosemont Rd to Lynnhaven Pkwy	152,200				28.8	13,700	D	154,000				29.4	13,900	D
Freeway	H4	First Colonial Rd to proposed Southeastern Pkwy	59,800				14.5	5,400	B	61,500				14.7	5,500	B
	I	*Dam Neck Rd (2 segments)*														
Arterial	I1	Holland Rd to London Bridge Ext	44,800				13.3	4,000	F	42,000				15.7	3,800	F
Arterial	I2	Proposed Southeastern Pkwy to Gen Booth Blvd	27,000				22.2	2,400	D	27,100				21.9	2,400	D
	J	*Birdneck Rd (2 segments)*														
Arterial	J1	I-264 to VA Beach Blvd	28,500				14.0	2,600	E	27,600				14.2	2,500	E
Arterial	J2	Gen Booth Blvd to Norfolk Ave	7,900				28.5	700	B	8,300				28.5	700	B
	K	*Battlefield Blvd (2 segments)*														
Arterial	K1	Great Bridge Bypass to Volvo Pkwy	59,200	19.7	4,100	E	20.4	4,800	E	48,900	23.1	3,400	D	23.2	4,000	D
Arterial	K2	Cedar Rd to Mt Pleasant Rd	35,100	13.8	2,400	E	13.8	2,600	E	34,000	14.0	2,300	E	13.4	2,500	E
	L	*Kempsville Rd (2 segments)*														
Arterial	L1	Centreville Tpk to Indian River Rd	31,800	16.4	2,400	E	14.8	2,800	F	31,200	16.5	2,300	E	15.0	2,800	F
Arterial	L2	Great Bridge Bypass to Greenbrier Pkwy	41,300	24.2	3,100	D	22.7	4,000	D	38,600	24.5	2,900	D	23.1	3,700	D
	M	*Indian River Rd (2 segments)*														
Arterial	M1	I-64 to Centreville Tpk	106,000				2.9	9,500	F	101,600				3.2	9,100	F
Arterial	M2	Independence Blvd to Elbow Rd	19,200				29.7	1,700	C	18,500				29.9	1,700	C
	N	*Oceana Blvd (2 segments)*														
Arterial	N1	Gen Booth Blvd to Tomcat Blvd/proposed Southeastern Pkwy	42,300				4.9	3,800	F	39,800				6.2	3,600	F
Arterial	N2	Tomcat Blvd/proposed Southeastern Pkwy to VA Beach Blvd	42,000				23.7	3,800	D	41,400				24.5	3,700	D
	BUILD SCENARIO - ALL ABOVE SEGMENTS, PLUS:															
	O	*Hampton Roads Crossing Segment 1 (2 segments)*														
Freeway	O1	Proposed EW Conn., I-564 to Hampton Blvd														
Freeway	O2	Proposed EW Conn., Hampton Blvd to I-664														
	P	*Hampton Roads Crossing (4 segments)*														
	P1/O1	Proposed EW Conn., I-564 to Hampton Blvd								21,200				7.7	1,900	A
	P2	Proposed EW Conn., Hampton Blvd to Craney Island Conn.								36,300				13.0	3,300	B
	P3	Proposed EW Conn., Craney Island Conn. to I-664								26,500				9.5	2,400	A
	P4	Proposed Craney Island Conn.								9,800				3.6	900	A
	Q	*Midtown Tunnel and MLK Frwy Extension (1 segment)*														
	Q1	MLK Frwy, I-264 to High St														

Planning Analysis		Segments	No Build ADT	No Build AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	No Build AM Peak Hour Calc. Volume	No Build AM Peak Hour LOS (HCS)	No Build PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	No Build PM Peak Hour Calc. Volume	No Build PM Peak Hour LOS (HCS)	Hampton Roads Crossing - Full ADT	Hampton Roads Crossing - Full AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Hampton Roads Crossing - Full AM Peak Hour Calc. Volume	Hampton Roads Crossing - Full AM Peak Hour LOS (HCS)	Hampton Roads Crossing - Full PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Hampton Roads Crossing - Full PM Peak Hour Calc. Volume	Hampton Roads Crossing - Full PM Peak Hour LOS (HCS)
	R	*New Alignment Route 460 (4 segments)*														
	R1	Route 58 Bypass to Windsor town limits														
	R2	Windsor town limits to Ivor														
	R3	Ivor to Wakefield														
	R4	Wakefield to Waverly														
	R5	Waverly to Route 625														
	R6	Route 625 to Route 156														
	R7	Route 156 to I-295														
	S	*Southeastern Parkway (6 segments)*														
	S1	Great Bridge Bypass to Centreville Tpk														
	S2	Centreville Tpk to Indian River Rd														
	S3	Indian River Rd to Princess Anne Rd														
	S4	Princess Anne Rd to Dam Neck Rd														
	S5	Dam Neck Rd to Oceana Blvd														
	S6	Oceana Blvd to I-264														

LEVEL OF SERVICE	A	B	C	D	E	F
FREEWAY (Density pc/mi/ln)	0-11	> 11-18	> 18-26	> 26-35	> 35-45	>45
ARTERIAL - CLASS 1 (Average Travel Speed mph)	>42	>34-42	>27-34	>21-27	>16-21	<=16
ARTERIAL - CLASS 2 (Average Travel Speed mph)	>35	>28-35	>22-28	>17-22	>13-17	<=13
ARTERIAL - CLASS 3 (Average Travel Speed mph)	>30	>24-30	>18-24	>14-18	>10-14	<=10

Notes*

1. PHF based on data from studies:Norfolk LOS study, Newport etc.
2. K factor based on HRPDC
3. D Factor based on HRPDC & Studies: etc.
4. Density for Freeway Segments (pc/mi/ln)
5. Average Travel Speed for Arterial Segments (mph)

*I-264 Corridor Study completed by URS.
Elbow Road Study completed by FHI.
I-264 Lynnhaven/Great Neck Interchange Study completed by FHI.

			Hampton Roads Crossing - Segment 1							Midtown Tunnel & MLK Extension						
Planning Analysis		**Segments**	**ADT**	**AM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**AM Peak Hour Calc. Volume**	**AM Peak Hour LOS (HCS)**	**PM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**PM Peak Hour Calc. Volume**	**PM Peak Hour LOS (HCS)**	**ADT**	**AM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**AM Peak Hour Calc. Volume**	**AM Peak Hour LOS (HCS)**	**PM Peak Hour Criteria** (Density[4]) (Avg Travel Speed[5])	**PM Peak Hour Calc. Volume**	**PM Peak Hour LOS (HCS)**
	A	*Hampton Roads Beltway (17 Segments)*														
Freeway	A1	I-64, I-664 to Armistead Ave	130,500				36.3	11,700	E	135,600				39.3	12,200	E
Freeway	A2	I-64, Armistead Ave to Hampton Roads Bridge Tunnel	106,400				26.2	9,600	D	112,100				28.0	10,100	D
Freeway	A3	Hampton Roads Bridge Tunnel	91,900				40.6	8,300	E	100,100				*	9,000	F
Freeway	A4	I-64, Hampton Roads Bridge Tunnel to I-564	90,300				41.2	8,100	E	94,200				44.5	8,500	E
Freeway	A5	I-64, I-564 to Chesapeake Blvd	160,400				*	14,400	F	159,200				*	14,300	F
Freeway	A6	I-64, Chesapeake Blvd to Northampton Blvd	171,700				*	15,500	F	169,900				*	15,300	F
Freeway	A7	I-64, Northampton Blvd to I-264	176,400				37.2	15,900	E	174,100				36.1	15,700	E
Freeway	A8	I-64, I-264 to Indian River Rd	158,000				30.4	14,200	D	158,600				30.6	14,300	D
Freeway	A9	I-64, Indian River Rd to Greenbrier Pkwy	145,600				27.0	13,100	D	146,700				27.3	13,200	D
Freeway	A10	I-64, Greenbrier Pkwy to I-464	129,900				23.5	11,700	C	132,100				23.9	11,900	C
Freeway	A11	I-64, I-464 to I-264	91,200				40.1	8,200	E	94,800				44.4	8,500	E
Freeway	A12	I-664, I-264 to Route 58	132,200				24.0	11,900	C	134,000				24.5	12,100	C
Freeway	A13	I-664, Route 58 to Route 164/Western Frwy	86,100				35.3	7,700	E	87,600				36.6	7,900	E
Freeway	A14	I-664, Route 164/Western Frwy to proposed EW Conn.	66,600				24.4	6,000	C	68,500				25.1	6,200	C
Freeway	A15	I-664, proposed EW Conn. to 23rd St	81,100				32.0	7,300	D	81,500				32.2	7,300	D
Freeway	A16	I-664, 23rd St to Aberdeen Rd	84,300				34.1	7,600	D	80,000				31.2	7,200	D
Freeway	A17	I-664, Aberdeen Rd to I-64	93,400				44.2	8,400	E	90,500				40.7	8,100	E
	B	*Midtown Tunnel area (3 segments)*														
Two-Lane	B1	Midtown Tunnel	49,100						F	23,600				-		E
Freeway	B2	MLK Frwy, High St to Pinner's Point Conn.								33,700				14.5	3,000	B
Freeway	B3	Western Frwy (Route 164, Town Point Rd to MLK Frwy	67,300				24.6	6,100	C	68,900				25.3	6,200	C
	C	*Route 460 (6 segments)*														
Multi-Lane	C1	I-664 to Route 58 Bypass	86,000		6,700	D		7,200	D	85,700	-	6,700	D	-	7,200	D
Freeway	C2	Route 58 Bypass														
Multi-Lane	C3	Route 58 Bypass to Windsor														
Multi-Lane	C4	Windsor to Waverly														
Multi-Lane	C5	Waverly to Route 156														
Multi-Lane	C6	Route 156 to I-295														
	D	*Oak Grove Conn. & Dominion Blvd (4 segments)*														
Two-Lane	D1	Dominion Blvd, Route 17 to Cedar Rd	12,300		800	E		1,000	E	12,200	-	800	E	-	1,000	E
Arterial	D2	Dominion Blvd, Cedar Rd to Bainbridge Blvd	36,400	2.8	2,800	F	3.1	3,100	F	36,800	2.7	2,900	F	3.0	3,100	F
Arterial	D3	Dominion Blvd, Bainbridge Blvd to Great Bridge Blvd														
Freeway	D4	Oak Grove Conn. (from I-64 to Battlefield Blvd)	129,100				*	11,600	F	131,500				*	11,800	F
	E	*Hampton Blvd & Brambleton Ave (5 segments)*														
Arterial	E1	Brambleton Ave to 21st St	36,700	9.9	2,500	F	6.4	2,800	F	27,100	13.9	1,900	E	13.5	2,000	E
Arterial	E2	38th St to Little Creek Rd	35,800	19.0	2,400	D	18.4	2,800	D	34,700	19.1	2,300	D	18.5	2,700	D
Arterial	E3	Little Creek Rd to proposed EW Conn.	32,800	20.8	2,300	D	21.4	2,500	D	33,200	20.7	2,300	D	21.4	2,600	D
Arterial	E4	Proposed EW Conn. to Adm Taussig Blvd	34,700	17.2	2,700	D	18.2	2,600	D	33,800	17.3	2,600	D	18.3	2,600	D
Arterial	E5	Brambleton Ave, Colley Ave to Boush St	65,500	4.1	5,300	F	3.5	5,500	F	54,800	6.6	4,400	F	5.3	4,600	F
	F	*Downtown Tunnel Area (5 segments)*														
Freeway	F1	Downtown Tunnel (I-264 from Portsmouth to I-464)	111,700				*	10,000	F	120,300				*	10,800	F
Freeway	F2	Berkley Bridge (I-264 from Waterside to I-464)	124,500				28.4	11,200	D	131,800				30.1	11,900	D
Two-Lane	F3	Jordan Bridge(Poindexter from Portsmouth to I-464)	12,500						E	15,800				-		E
Arterial	F4	Effingham St, I-264 to South St	38,000	1.8	3,800	F	1.8	3,800	F	35,700	2.2	3,600	F	2.2	3,600	F
Arterial	F5	Frederick Blvd, I-264 to Turnpike Rd	47,400	2.5	4,700	F	2.5	4,700	F	42,900	3.1	4,300	F	3.1	4,300	F

Planning Analysis		Segments	Hampton Roads Crossing - Segment 1 ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)	Midtown Tunnel & MLK Extension ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
	G	*I-64 (on the Peninsula) (5 segments)*														
Freeway	G1	New Kent County Line to Route 30 (Exit 227)	9,600				3.5	900	A	9,600				3.5	900	A
Freeway	G2	Route 30 (Exit 220) to Croaker Rd (Exit 231)	68,400				25.0	6,200	C	68,400				25.0	6,200	C
Freeway	G3	Croaker Rd (Exit 231) to Route 199 @ Lightfoot (Exit 234)	84,500				34.0	7,600	D	84,500				34.1	7,600	D
Freeway	G4	Route 199 @ Lightfoot (Exit 234) to Camp Peary Rd (Exit 238)	76,800				29.2	6,900	D	76,800				29.2	6,900	D
Freeway	G5	Camp Peary Rd (Exit 238) to Route 199 @ Kingsmill (Exit 242)	81,300				31.9	7,300	D	81,100				31.8	7,300	D
	H	*I-264 (4 segments)*														
Freeway	H1	Witchduck Rd to Independence Blvd	225,600				*	20,300	F	223,400				*	20,100	F
Freeway	H2	Independence Blvd to Rosemont Rd	182,200				39.7	16,400	E	181,200				39.4	16,300	E
Freeway	H3	Rosemont Rd to Lynnhaven Pkwy	154,000				29.4	13,900	D	153,800				29.2	13,800	D
Freeway	H4	First Colonial Rd to proposed Southeastern Pkwy	61,900				14.8	5,600	B	61,700				14.7	5,600	B
	I	*Dam Neck Rd (2 segments)*														
Arterial	I1	Holland Rd to London Bridge Ext	42,300				15.5	3,800	F	42,100				15.7	3,800	F
Arterial	I2	Proposed Southeastern Pkwy to Gen Booth Blvd	27,100				21.9	2,400	D	27,100				21.9	2,400	D
	J	*Birdneck Rd (2 segments)*														
Arterial	J1	I-264 to VA Beach Blvd	27,700				14.1	2,500	E	27,600				14.2	2,500	E
Arterial	J2	Gen Booth Blvd to Norfolk Ave	8,400				28.4	800	B	8,400				28.5	800	B
	K	*Battlefield Blvd (2 segments)*														
Arterial	K1	Great Bridge Bypass to Volvo Pkwy	48,000	23.3	3,300	D	23.3	3,900	D	49,400	23.0	3,400	D	23.1	4,000	D
Arterial	K2	Cedar Rd to Mt Pleasant Rd	33,700	14.0	2,300	E	13.5	2,500	E	35,200	13.8	2,400	E	13.2	2,600	E
	L	*Kempsville Rd (2 segments)*														
Arterial	L1	Centreville Tpk to Indian River Rd	31,300	16.4	2,300	E	14.9	2,800	F	31,300	16.4	2,300	E	14.9	2,800	F
Arterial	L2	Great Bridge Bypass to Greenbrier Pkwy	38,500	24.5	2,900	D	23.1	3,700	D	38,700	24.5	2,900	D	23.1	3,700	D
	M	*Indian River Rd (2 segments)*														
Arterial	M1	I-64 to Centreville Tpk	101,100				3.3	9,100	F	101,400				3.3	9,100	F
Arterial	M2	Independence Blvd to Elbow Rd	18,400				29.9	1,700	C	18,300				29.9	1,700	C
	N	*Oceana Blvd (2 segments)*														
Arterial	N1	Gen Booth Blvd to Tomcat Blvd/proposed Southeastern Pkwy	39,800				6.2	3,600	F	39,900				6.1	3,600	F
Arterial	N2	Tomcat Blvd/proposed Southeastern Pkwy to VA Beach Blvd	41,600				24.2	3,700	D	41,500				24.3	3,700	D
	BUILD SCENARIO - ALL ABOVE SEGMENTS, PLUS:															
	O	*Hampton Roads Crossing Segment 1 (2 segments)*														
Freeway	O1	Proposed EW Conn., I-564 to Hampton Blvd	17,800				12.7	1,600	B							
Freeway	O2	Proposed EW Conn., Hampton Blvd to I-664	29,300				20.9	2,600	C							
	P	*Hampton Roads Crossing (4 segments)*														
	P1/O1	Proposed EW Conn., I-564 to Hampton Blvd														
	P2	Proposed EW Conn., Hampton Blvd to Craney Island Conn.														
	P3	Proposed EW Conn., Craney Island Conn. to I-664														
	P4	Proposed Craney Island Conn.														
	Q	*Midtown Tunnel and MLK Frwy Extension (1 segment)*														
	Q1	MLK Frwy, I-264 to High St								11,000				3.9	1,000	A

Planning Analysis	Segments	Hampton Roads Crossing - Segment 1							Midtown Tunnel & MLK Extension						
		ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)	ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
R	*New Alignment Route 460 (4 segments)*														
R1	Route 58 Bypass to Windsor town limits														
R2	Windsor town limits to Ivor														
R3	Ivor to Wakefield														
R4	Wakefield to Waverly														
R5	Waverly to Route 625														
R6	Route 625 to Route 156														
R7	Route 156 to I-295														
S	*Southeastern Parkway (6 segments)*														
S1	Great Bridge Bypass to Centreville Tpk														
S2	Centreville Tpk to Indian River Rd														
S3	Indian River Rd to Princess Anne Rd														
S4	Princess Anne Rd to Dam Neck Rd														
S5	Dam Neck Rd to Oceana Blvd														
S6	Oceana Blvd to I-264														

LEVEL OF SERVICE	A	B	C	D	E	F
FREEWAY (Density pc/mi/ln)	0-11	> 11-18	> 18-26	> 26-35	> 35-45	>45
ARTERIAL - CLASS 1 (Average Travel Speed mph)	>42	>34-42	>27-34	>21-27	>16-21	<=16
ARTERIAL - CLASS 2 (Average Travel Speed mph)	>35	>28-35	>22-28	>17-22	>13-17	<=13
ARTERIAL - CLASS 3 (Average Travel Speed mph)	>30	>24-30	>18-24	>14-18	>10-14	<=10

Notes*

1. PHF based on data from studies:Norfolk LOS study, Newport etc.
2. K factor based on HRPDC
3. D Factor based on HRPDC & Studies: etc.
4. Density for Freeway Segments (pc/mi/ln)
5. Average Travel Speed for Arterial Segments (mph)

*I-264 Corridor Study completed by URS.
Elbow Road Study completed by FHI.
I-264 Lynnhaven/Great Neck Interchange Study completed by FHI.

Planning Analysis		Segments	Southeastern Parkway & Greenbelt ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)	Route 460 Realignment ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
	A	*Hampton Roads Beltway (17 Segments)*														
Freeway	A1	I-64, I-664 to Armistead Ave	135,500				39.1	12,200	E	130,800				36.4	11,800	E
Freeway	A2	I-64, Armistead Ave to Hampton Roads Bridge Tunnel	111,400				27.8	10,000	D	106,200				26.1	9,600	D
Freeway	A3	Hampton Roads Bridge Tunnel	99,300				*	8,900	F	92,900				41.9	8,400	E
Freeway	A4	I-64, Hampton Roads Bridge Tunnel to I-564	95,000				44.2	8,500	E	90,700				41.3	8,200	E
Freeway	A5	I-64, I-564 to Chesapeake Blvd	159,900				*	14,400	F	151,700				*	13,700	F
Freeway	A6	I-64, Chesapeake Blvd to Northampton Blvd	172,100				*	15,500	F	164,600				*	14,800	F
Freeway	A7	I-64, Northampton Blvd to I-264	175,800				36.8	15,800	E	168,100				34.1	15,100	D
Freeway	A8	I-64, I-264 to Indian River Rd	154,700				29.5	13,900	D	156,700				30.1	14,100	D
Freeway	A9	I-64, Indian River Rd to Greenbrier Pkwy	130,600				23.9	11,800	C	147,000				27.4	13,200	D
Freeway	A10	I-64, Greenbrier Pkwy to I-464	109,700				20.3	9,900	C	130,500				23.7	11,700	C
Freeway	A11	I-64, I-464 to I-264	92,000				42.1	8,300	E	94,400				43.5	8,500	E
Freeway	A12	I-664, I-264 to Route 58	135,100				24.6	12,200	C	154,000				29.4	13,900	D
Freeway	A13	I-664, Route 58 to Route 164/Western Frwy	88,400				37.2	8,000	E	83,300				33.2	7,500	D
Freeway	A14	I-664, Route 164/Western Frwy to proposed EW Conn.	68,800				25.3	6,200	C	62,800				22.7	5,600	C
Freeway	A15	I-664, proposed EW Conn. to 23rd St	81,700				32.2	7,400	D	74,200				27.8	6,700	D
Freeway	A16	I-664, 23rd St to Aberdeen Rd	80,300				31.2	7,200	D	74,300				28.1	6,700	D
Freeway	A17	I-664, Aberdeen Rd to I-64	91,100				41.2	8,200	E	86,300				36.6	7,800	E
	B	*Midtown Tunnel area (3 segments)*														
Two-Lane	B1	Midtown Tunnel	52,200				-		F	52,800				-		F
Freeway	B2	MLK Frwy, High St to Pinner's Point Conn.	29,600				12.7	2,700	B							
Freeway	B3	Western Frwy (Route 164, Town Point Rd to MLK Frwy	74,900				28.4	6,700	D	72,400				27.1	6,500	D
	C	*Route 460 (6 segments)*														
Multi-Lane	C1	I-664 to Route 58 Bypass	86,100	-	6,700	D	-	7,200	D	110,900	-	8,600	E	-	9,300	E
Freeway	C2	Route 58 Bypass														
Multi-Lane	C3	Route 58 Bypass to Windsor								25,100	-	1,800	B	-	2,400	B
Multi-Lane	C4	Windsor to Waverly								24,200	-	1,700	B	-	2,300	B
Multi-Lane	C5	Waverly to Route 156								23,600	-	1,700	B	-	2,300	B
Multi-Lane	C6	Route 156 to I-295								23,900	-	1,700	B	-	2,300	B
	D	*Oak Grove Conn. & Dominion Blvd (4 segments)*														
Two-Lane	D1	Dominion Blvd, Route 17 to Cedar Rd	11,900	-	700	E	-	900	E	12,400	-	800	E	-	1,000	E
Arterial	D2	Dominion Blvd, Cedar Rd to Bainbridge Blvd	20,700	8.8	1,600	F	10.7	1,700	F	36,800	2.7	2,900	F	3.0	3,100	F
Arterial	D3	Dominion Blvd, Bainbridge Blvd to Great Bridge Blvd	25,900	8.8	1,900	F	11.9	2,100	F							
Freeway	D4	Oak Grove Conn. (from I-64 to Battlefield Blvd)	112,400				*	10,100	F	128,500				*	11,600	F
	E	*Hampton Blvd & Brambleton Ave (5 segments)*														
Arterial	E1	Brambleton Ave to 21st St	39,000	6.9	2,700	F	4.8	2,900	F	39,600	6.3	2,700	F	4.5	3,000	F
Arterial	E2	38th St to Little Creek Rd	37,000	18.9	2,400	D	18.2	2,900	D	36,800	18.9	2,400	D	18.2	2,900	D
Arterial	E3	Little Creek Rd to proposed EW Conn.	33,900	20.5	2,400	D	21.3	2,600	D	34,400	20.4	2,400	D	21.2	2,600	D
Arterial	E4	Proposed EW Conn. to Adm Taussig Blvd	34,200	17.2	2,600	D	18.2	2,600	D	34,700	17.2	2,700	D	18.2	2,600	D
Arterial	E5	Brambleton Ave, Colley Ave to Boush St	65,900	4.0	5,300	F	3.4	5,500	F	61,700	4.7	5,000	F	3.9	5,200	F
	F	*Downtown Tunnel Area (5 segments)*														
Freeway	F1	Downtown Tunnel (I-264 from Portsmouth to I-464)	114,200				*	10,300	F	118,800				*	10,700	F
Freeway	F2	Berkley Bridge (I-264 from Waterside to I-464)	120,800				27.7	10,900	D	128,500				29.3	11,600	D
Two-Lane	F3	Jordan Bridge(Poindexter from Portsmouth to I-464)	13,500				-		E	14,200				-		E
Arterial	F4	Effingham St, I-264 to South St	39,800	1.6	4,000	F	1.6	4,000	F	37,700	1.9	3,800	F	1.9	3,800	F
Arterial	F5	Frederick Blvd, I-264 to Turnpike Rd	47,600	2.4	4,800	F	2.4	4,800	F	47,700	2.4	4,800	F	2.4	4,800	F

Planning Analysis		Segments	Southeastern Parkway & Greenbelt ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)	Route 460 Realignment ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
	G	*I-64 (on the Peninsula) (5 segments)*														
Freeway	G1	New Kent County Line to Route 30 (Exit 227)	9,600				3.5	900	A	10,800				3.9	1,000	A
Freeway	G2	Route 30 (Exit 220) to Croaker Rd (Exit 231)	68,400				25.0	6,200	C	55,000				19.8	5,000	C
Freeway	G3	Croaker Rd (Exit 231) to Route 199 @ Lightfoot (Exit 234)	84,500				34.1	7,600	D	72,500				26.9	6,500	D
Freeway	G4	Route 199 @ Lightfoot (Exit 234) to Camp Peary Rd (Exit 238)	76,800				29.1	6,900	D	66,600				24.2	6,000	C
Freeway	G5	Camp Peary Rd (Exit 238) to Route 199 @ Kingsmill (Exit 242)	81,400				32.0	7,300	D	68,900				25.2	6,200	C
	H	*I-264 (4 segments)*														
Freeway	H1	Witchduck Rd to Independence Blvd	218,200				*	19,600	F	218,400				*	19,700	F
Freeway	H2	Independence Blvd to Rosemont Rd	176,900				37.2	15,900	E	175,700				37.1	15,800	E
Freeway	H3	Rosemont Rd to Lynnhaven Pkwy	151,600				28.7	13,600	D	149,400				28.1	13,400	D
Freeway	H4	First Colonial Rd to proposed Southeastern Pkwy	73,400				17.6	6,600	B	57,600				13.8	5,200	B
	I	*Dam Neck Rd (2 segments)*														
Arterial	I1	Holland Rd to London Bridge Ext	37,300				22.9	3,400	D	41,500				16.4	3,700	E
Arterial	I2	Proposed Southeastern Pkwy to Gen Booth Blvd	39,600				8.9	3,600	F	26,800				22.0	2,400	D
	J	*Birdneck Rd (2 segments)*														
Arterial	J1	I-264 to VA Beach Blvd	23,400				15.0	2,100	E	27,100				14.3	2,400	E
Arterial	J2	Gen Booth Blvd to Norfolk Ave	3,800				29.1	300	B	8,100				28.5	700	B
	K	*Battlefield Blvd (2 segments)*														
Arterial	K1	Great Bridge Bypass to Volvo Pkwy	74,000	7.0	5,100	F	7.2	6,000	F	47,400	23.3	3,300	D	23.4	3,800	D
Arterial	K2	Cedar Rd to Mt Pleasant Rd	33,800	14.0	2,300	E	13.5	2,500	E	35,100	13.8	2,400	E	13.2	2,600	E
	L	*Kempsville Rd (2 segments)*														
Arterial	L1	Centreville Tpk to Indian River Rd	32,900	16.2	2,400	E	14.6	2,900	F	30,900	16.5	2,300	E	15.0	2,700	F
Arterial	L2	Great Bridge Bypass to Greenbrier Pkwy	40,100	24.4	3,000	D	22.9	3,800	D	38,700	24.5	2,900	D	23.1	3,700	D
	M	*Indian River Rd (2 segments)*														
Arterial	M1	I-64 to Centreville Tpk	100,600				3.3	9,100	F	100,600				3.3	9,100	F
Arterial	M2	Independence Blvd to Elbow Rd	17,500				30.1	1,600	C	18,400				29.9	1,700	C
	N	*Oceana Blvd (2 segments)*														
Arterial	N1	Gen Booth Blvd to Tomcat Blvd/proposed Southeastern Pkwy	43,200				4.6	3,900	F	39,700				6.3	3,600	F
Arterial	N2	Tomcat Blvd/proposed Southeastern Pkwy to VA Beach Blvd	31,100				40.9	2,800	B	41,000				25.0	3,700	D
	BUILD SCENARIO - ALL ABOVE SEGMENTS, PLUS:															
	O	*Hampton Roads Crossing Segment 1 (2 segments)*														
Freeway	O1	Proposed EW Conn., I-564 to Hampton Blvd														
Freeway	O2	Proposed EW Conn., Hampton Blvd to I-664														
	P	*Hampton Roads Crossing (4 segments)*														
	P1/O1	Proposed EW Conn., I-564 to Hampton Blvd														
	P2	Proposed EW Conn., Hampton Blvd to Craney Island Conn.														
	P3	Proposed EW Conn., Craney Island Conn. to I-664														
	P4	Proposed Craney Island Conn.														
	Q	*Midtown Tunnel and MLK Frwy Extension (1 segment)*														
	Q1	MLK Frwy, I-264 to High St														

Planning Analysis	Segments	Southeastern Parkway & Greenbelt ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)	Route 460 Realignment ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
R	*New Alignment Route 460 (4 segments)*														
R1	Route 58 Bypass to Windsor town limits								20,700				7.4	1,900	A
R2	Windsor town limits to Ivor								15,100				5.4	1,400	A
R3	Ivor to Wakefield								15,700				5.6	1,400	A
R4	Wakefield to Waverly								15,000				5.4	1,400	A
R5	Waverly to Route 625								8,600				3.1	800	A
R6	Route 625 to Route 156								9,500				3.4	900	A
R7	Route 156 to I-295								9,600				3.6	900	A
S	*Southeastern Parkway (6 segments)*														
S1	Great Bridge Bypass to Centreville Tpk	35,000				12.6	3,200	B							
S2	Centreville Tpk to Indian River Rd	34,400				12.4	3,100	B							
S3	Indian River Rd to Princess Anne Rd	14,100				*5.1*	1,300	*A*							
S4	Princess Anne Rd to Dam Neck Rd	16,100				5.8	1,500	A							
S5	Dam Neck Rd to Oceana Blvd	9,400				3.4	800	A							
S6	Oceana Blvd to I-264	25,000				8.9	2,300	A							

LEVEL OF SERVICE	A	B	C	D	E	F
FREEWAY (Density pc/mi/ln)	0-11	> 11-18	> 18-26	> 26-35	> 35-45	>45
ARTERIAL - CLASS 1 (Average Travel Speed mph)	>42	>34-42	>27-34	>21-27	>16-21	<=16
ARTERIAL - CLASS 2 (Average Travel Speed mph)	>35	>28-35	>22-28	>17-22	>13-17	<=13
ARTERIAL - CLASS 3 (Average Travel Speed mph)	>30	>24-30	>18-24	>14-18	>10-14	<=10

Notes*

1. PHF based on data from studies:Norfolk LOS study, Newport etc.
2. K factor based on HRPDC
3. D Factor based on HRPDC & Studies: etc.
4. Density for Freeway Segments (pc/mi/ln)
5. Average Travel Speed for Arterial Segments (mph)

*I-264 Corridor Study completed by URS.
Elbow Road Study completed by FHI.
I-264 Lynnhaven/Great Neck Interchange Study completed by FHI.

Planning Analysis		Segments	Project Scenario 1 ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)	Project Scenario 2 ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
	A	*Hampton Roads Beltway (17 Segments)*														
Freeway	A1	I-64, I-664 to Armistead Ave	115,500				29.2	10,400	D	85,400				20.7	7,700	C
Freeway	A2	I-64, Armistead Ave to Hampton Roads Bridge Tunnel	90,700				21.7	8,200	C	58,100				13.9	5,200	B
Freeway	A3	Hampton Roads Bridge Tunnel	66,800				24.4	6,000	C	64,300				23.3	5,800	C
Freeway	A4	I-64, Hampton Roads Bridge Tunnel to I-564	74,200				28.8	6,700	D	26,600				10.0	2,400	A
Freeway	A5	I-64, I-564 to Chesapeake Blvd	151,800				*	13,700	F	140,700				42.8	12,700	E
Freeway	A6	I-64, Chesapeake Blvd to Northampton Blvd	162,200				*	14,600	F	158,100				*	14,200	F
Freeway	A7	I-64, Northampton Blvd to I-264	169,700				34.7	15,300	D	166,300				33.4	15,000	D
Freeway	A8	I-64, I-264 to Indian River Rd	152,600				29.0	13,700	D	149,100				28.1	13,400	D
Freeway	A9	I-64, Indian River Rd to Greenbrier Pkwy	143,800				26.6	12,900	D	142,700				26.4	12,800	D
Freeway	A10	I-64, Greenbrier Pkwy to I-464	131,500				23.9	11,800	C	131,900				24.0	11,900	C
Freeway	A11	I-64, I-464 to I-264	82,100				32.3	7,400	D	92,400				41.2	8,300	E
Freeway	A12	I-664, I-264 to Route 58	85,000				15.4	7,600	B	129,000				23.5	11,600	C
Freeway	A13	I-664, Route 58 to Route 164/Western Frwy	30,400				10.9	2,700	A	83,900				33.8	7,500	D
Freeway	A14	I-664, Route 164/Western Frwy to proposed EW Conn.	15,500				5.7	1,400	A	60,400				21.7	5,400	C
Freeway	A15	I-664, proposed EW Conn. to 23rd St	32,300				11.7	2,900	B	71,100				26.4	6,400	D
Freeway	A16	I-664, 23rd St to Aberdeen Rd	17,200				6.9	1,500	A	75,500				29.1	6,800	D
Freeway	A17	I-664, Aberdeen Rd to I-64	28,000				10.4	2,500	A	87,800				39.0	7,900	E
	B	*Midtown Tunnel area (3 segments)*														
Two-Lane	B1	Midtown Tunnel	45,100				-		F	50,800				-		F
Freeway	B2	MLK Frwy, High St to Pinner's Point Conn.	32,000				11.7	2,900	B							
Freeway	B3	Western Frwy (Route 164, Town Point Rd to MLK Frwy	70,900				26.3	6,400	D	76,400				29.0	6,900	D
	C	*Route 460 (6 segments)*														
Multi-Lane	C1	I-664 to Route 58 Bypass	77,600	-	6,100	C	-	6,500	C	85,000	-	6,600	D	-	7,100	C
Freeway	C2	Route 58 Bypass														
Multi-Lane	C3	Route 58 Bypass to Windsor														
Multi-Lane	C4	Windsor to Waverly														
Multi-Lane	C5	Waverly to Route 156														
Multi-Lane	C6	Route 156 to I-295														
	D	*Oak Grove Conn. & Dominion Blvd (4 segments)*														
Two-Lane	D1	Dominion Blvd, Route 17 to Cedar Rd	12,800	-	800	E	-	1,000	E	12,700	-	800	E	-	1,000	E
Arterial	D2	Dominion Blvd, Cedar Rd to Bainbridge Blvd	36,900	2.7	2,900	F	3.0	3,100	F	37,300	2.7	2,900	F	3.0	3,100	F
Arterial	D3	Dominion Blvd, Bainbridge Blvd to Great Bridge Blvd														
Freeway	D4	Oak Grove Conn. (from I-64 to Battlefield Blvd)	130,700				*	11,800	F	132,600				*	11,900	F
	E	*Hampton Blvd & Brambleton Ave (5 segments)*														
Arterial	E1	Brambleton Ave to 21st St	34,200	12.4	2,400	F	9.8	2,600	F	36,800	9.7	2,500	F	6.3	2,800	F
Arterial	E2	38th St to Little Creek Rd	36,600	18.9	2,400	D	18.2	2,900	D	34,600	19.1	2,300	D	18.5	2,700	D
Arterial	E3	Little Creek Rd to proposed EW Conn.	34,700	20.4	2,400	D	21.1	2,700	D	31,700	21.0	2,200	D	21.6	2,400	D
Arterial	E4	Proposed EW Conn. to Adm Taussig Blvd	29,700	18.0	2,300	D	18.8	2,300	D	32,500	17.5	2,500	D	18.4	2,500	D
Arterial	E5	Brambleton Ave, Colley Ave to Boush St	67,800	3.8	5,500	F	3.2	5,700	F	69,600	3.6	5,600	F	3.0	5,800	F
	F	*Downtown Tunnel Area (5 segments)*														
Freeway	F1	Downtown Tunnel (I-264 from Portsmouth to I-464)	106,000				*	9,500	F	113,300				*	10,200	F
Freeway	F2	Berkley Bridge (I-264 from Waterside to I-464)	132,900				30.4	12,000	D	136,000				31.1	12,200	D
Two-Lane	F3	Jordan Bridge(Poindexter from Portsmouth to I-464)	18,000				-		E	21,000				-		E
Arterial	F4	Effingham St, I-264 to South St	37,600	1.9	3,800	F	1.9	3,800	F	38,900	1.7	3,900	F	1.7	3,900	F
Arterial	F5	Frederick Blvd, I-264 to Turnpike Rd	46,700	2.6	4,700	F	2.6	4,700	F	46,100	2.6	4,600	F	2.6	4,600	F

Planning Analysis		Segments	Project Scenario 1 ADT	Project Scenario 1 AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 1 AM Peak Hour Calc. Volume	Project Scenario 1 AM Peak Hour LOS (HCS)	Project Scenario 1 PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 1 PM Peak Hour Calc. Volume	Project Scenario 1 PM Peak Hour LOS (HCS)	Project Scenario 2 ADT	Project Scenario 2 AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 2 AM Peak Hour Calc. Volume	Project Scenario 2 AM Peak Hour LOS (HCS)	Project Scenario 2 PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 2 PM Peak Hour Calc. Volume	Project Scenario 2 PM Peak Hour LOS (HCS)
	G	*I-64 (on the Peninsula) (5 segments)*														
Freeway	G1	New Kent County Line to Route 30 (Exit 227)	9,600				3.5	900	A	9,600				3.5	900	A
Freeway	G2	Route 30 (Exit 220) to Croaker Rd (Exit 231)	67,700				24.7	6,100	C	67,700				24.7	6,100	C
Freeway	G3	Croaker Rd (Exit 231) to Route 199 @ Lightfoot (Exit 234)	81,400				31.9	7,300	D	81,500				32.0	7,300	D
Freeway	G4	Route 199 @ Lightfoot (Exit 234) to Camp Peary Rd (Exit 238)	71,700				26.5	6,500	D	72,100				26.7	6,500	D
Freeway	G5	Camp Peary Rd (Exit 238) to Route 199 @ Kingsmill (Exit 242)	75,500				28.5	6,800	D	75,900				28.7	6,800	D
	H	*I-264 (4 segments)*														
Freeway	H1	Witchduck Rd to Independence Blvd	215,700				*	19,400	F	214,500				*	19,300	F
Freeway	H2	Independence Blvd to Rosemont Rd	176,600				37.8	15,900	E	176,100				37.5	15,800	E
Freeway	H3	Rosemont Rd to Lynnhaven Pkwy	150,300				28.2	13,500	D	150,200				28.2	13,500	D
Freeway	H4	First Colonial Rd to proposed Southeastern Pkwy	63,600				15.2	5,700	B	63,800				15.3	5,700	B
	I	*Dam Neck Rd (2 segments)*														
Arterial	I1	Holland Rd to London Bridge Ext	42,200				15.6	3,800	F	42,300				15.5	3,800	F
Arterial	I2	Proposed Southeastern Pkwy to Gen Booth Blvd	28,000				21.7	2,500	D	27,900				21.7	2,500	D
	J	*Birdneck Rd (2 segments)*														
Arterial	J1	I-264 to VA Beach Blvd	27,000				14.3	2,400	E	26,900				14.3	2,400	E
Arterial	J2	Gen Booth Blvd to Norfolk Ave	9,800				28.2	900	B	9,800				28.2	900	B
	K	*Battlefield Blvd (2 segments)*														
Arterial	K1	Great Bridge Bypass to Volvo Pkwy	49,200	23.1	3,400	D	23.1	4,000	D	48,900	23.1	3,400	D	23.2	4,000	D
Arterial	K2	Cedar Rd to Mt Pleasant Rd	42,500	11.8	2,800	F	6.3	3,100	F	42,200	12.0	2,800	F	6.6	3,100	F
	L	*Kempsville Rd (2 segments)*														
Arterial	L1	Centreville Tpk to Indian River Rd	32,900	16.2	2,400	E	14.9	2,900	F	32,700	16.2	2,400	E	14.6	2,900	F
Arterial	L2	Great Bridge Bypass to Greenbrier Pkwy	38,100	24.6	2,800	D	23.2	3,700	D	37,800	24.6	2,800	D	23.2	3,600	D
	M	*Indian River Rd (2 segments)*														
Arterial	M1	I-64 to Centreville Tpk	100,500				3.3	9,000	F	101,000				3.3	9,100	F
Arterial	M2	Independence Blvd to Elbow Rd	18,300				30.0	1,600	C	18,400				29.9	1,700	C
	N	*Oceana Blvd (2 segments)*														
Arterial	N1	Gen Booth Blvd to Tomcat Blvd/proposed Southeastern Pkwy	38,400				7.2	3,500	F	38,200				7.4	3,400	F
Arterial	N2	Tomcat Blvd/proposed Southeastern Pkwy to VA Beach Blvd	39,400				27.4	3,500	C	39,400				27.4	3,500	C
		BUILD SCENARIO - ALL ABOVE SEGMENTS, PLUS:														
	O	*Hampton Roads Crossing Segment 1 (2 segments)*														
Freeway	O1	Proposed EW Conn., I-564 to Hampton Blvd														
Freeway	O2	Proposed EW Conn., Hampton Blvd to I-664														
	P	*Hampton Roads Crossing (4 segments)*														
	P1/O1	Proposed EW Conn., I-564 to Hampton Blvd	19,500				7.2	1,800	A							
	P2	Proposed EW Conn., Hampton Blvd to Craney Island Conn.	33,000				11.9	3,000	B							
	P3	Proposed EW Conn., Craney Island Conn. to I-664	25,100				9.1	2,300	A							
	P4	Proposed Craney Island Conn.	7,900				2.8	700	A							
	Q	*Midtown Tunnel and MLK Frwy Extension (1 segment)*														
	Q1	MLK Frwy, I-264 to High St														

Planning Analysis	Segments	Project Scenario 1 ADT	Project Scenario 1 AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 1 AM Peak Hour Calc. Volume	Project Scenario 1 AM Peak Hour LOS (HCS)	Project Scenario 1 PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 1 PM Peak Hour Calc. Volume	Project Scenario 1 PM Peak Hour LOS (HCS)	Project Scenario 2 ADT	Project Scenario 2 AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 2 AM Peak Hour Calc. Volume	Project Scenario 2 AM Peak Hour LOS (HCS)	Project Scenario 2 PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	Project Scenario 2 PM Peak Hour Calc. Volume	Project Scenario 2 PM Peak Hour LOS (HCS)
R	*New Alignment Route 460 (4 segments)*														
R1	Route 58 Bypass to Windsor town limits														
R2	Windsor town limits to Ivor														
R3	Ivor to Wakefield														
R4	Wakefield to Waverly														
R5	Waverly to Route 625														
R6	Route 625 to Route 156														
R7	Route 156 to I-295														
S	*Southeastern Parkway (6 segments)*														
S1	Great Bridge Bypass to Centreville Tpk														
S2	Centreville Tpk to Indian River Rd														
S3	Indian River Rd to Princess Anne Rd														
S4	Princess Anne Rd to Dam Neck Rd														
S5	Dam Neck Rd to Oceana Blvd														
S6	Oceana Blvd to I-264														

LEVEL OF SERVICE	A	B	C	D	E	F
FREEWAY (Density pc/mi/ln)	0-11	> 11-18	> 18-26	> 26-35	> 35-45	>45
ARTERIAL - CLASS 1 (Average Travel Speed mph)	>42	>34-42	>27-34	>21-27	>16-21	<=16
ARTERIAL - CLASS 2 (Average Travel Speed mph)	>35	>28-35	>22-28	>17-22	>13-17	<=13
ARTERIAL - CLASS 3 (Average Travel Speed mph)	>30	>24-30	>18-24	>14-18	>10-14	<=10

Notes*

1. PHF based on data from studies:Norfolk LOS study, Newport etc.
2. K factor based on HRPDC
3. D Factor based on HRPDC & Studies: etc.
4. Density for Freeway Segments (pc/mi/ln)
5. Average Travel Speed for Arterial Segments (mph)

*I-264 Corridor Study completed by URS.
Elbow Road Study completed by FHI.
I-264 Lynnhaven/Great Neck Interchange Study completed by FHI.

Project Scenario 3

Planning Analysis		Segments	ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
	A	*Hampton Roads Beltway (17 Segments)*							
Freeway	A1	I-64, I-664 to Armistead Ave	133,300				38.1	12,000	E
Freeway	A2	I-64, Armistead Ave to Hampton Roads Bridge Tunnel	112,000				28.1	10,100	D
Freeway	A3	Hampton Roads Bridge Tunnel	104,400				*	9,400	F
Freeway	A4	I-64, Hampton Roads Bridge Tunnel to I-564	93,500				42.6	8,400	E
Freeway	A5	I-64, I-564 to Chesapeake Blvd	155,200				*	14,000	F
Freeway	A6	I-64, Chesapeake Blvd to Northampton Blvd	163,600				*	14,700	F
Freeway	A7	I-64, Northampton Blvd to I-264	171,200				35.1	15,400	E
Freeway	A8	I-64, I-264 to Indian River Rd	158,100				30.5	14,200	D
Freeway	A9	I-64, Indian River Rd to Greenbrier Pkwy	154,800				29.6	13,900	D
Freeway	A10	I-64, Greenbrier Pkwy to I-464	144,200				26.8	13,000	D
Freeway	A11	I-64, I-464 to I-264	115,200				*	10,400	F
Freeway	A12	I-664, I-264 to Route 58	125,300				22.8	11,300	C
Freeway	A13	I-664, Route 58 to Route 164/Western Frwy	88,300				37.4	7,900	E
Freeway	A14	I-664, Route 164/Western Frwy to proposed EW Conn.	64,300				23.3	5,800	C
Freeway	A15	I-664, proposed EW Conn. to 23rd St	79,000				30.6	7,100	D
Freeway	A16	I-664, 23rd St to Aberdeen Rd	80,300				32.5	7,200	D
Freeway	A17	I-664, Aberdeen Rd to I-64	83,900				35.9	7,500	E
	B	*Midtown Tunnel area (3 segments)*							
Two-Lane	B1	Midtown Tunnel	23,800				-		E
Freeway	B2	MLK Frwy, High St to Pinner's Point Conn.							
Freeway	B3	Western Frwy (Route 164, Town Point Rd to MLK Frwy	62,600				22.6	5,600	C
	C	*Route 460 (6 segments)*							
Multi-Lane	C1	I-664 to Route 58 Bypass	84,800	-	6,600	D	-	7,100	C
Freeway	C2	Route 58 Bypass							
Multi-Lane	C3	Route 58 Bypass to Windsor							
Multi-Lane	C4	Windsor to Waverly							
Multi-Lane	C5	Waverly to Route 156							
Multi-Lane	C6	Route 156 to I-295							
	D	*Oak Grove Conn. & Dominion Blvd (4 segments)*							
Two-Lane	D1	Dominion Blvd, Route 17 to Cedar Rd	13,000	-	800	E	-	1,000	E
Arterial	D2	Dominion Blvd, Cedar Rd to Bainbridge Blvd	36,900	2.7	2,900	F	3.0	3,100	F
Arterial	D3	Dominion Blvd, Bainbridge Blvd to Great Bridge Blvd							
Freeway	D4	Oak Grove Conn. (from I-64 to Battlefield Blvd)	146,800				*	13,200	F
	E	*Hampton Blvd & Brambleton Ave (5 segments)*							
Arterial	E1	Brambleton Ave to 21st St	25,300	14.3	1,700	E	13.9	1,900	E
Arterial	E2	38th St to Little Creek Rd	36,800	18.9	2,400	D	18.2	2,900	D
Arterial	E3	Little Creek Rd to proposed EW Conn.	33,900	20.5	2,400	D	21.3	2,600	D
Arterial	E4	Proposed EW Conn. to Adm Taussig Blvd	34,100	17.3	2,600	D	18.3	2,600	D
Arterial	E5	Brambleton Ave, Colley Ave to Boush St	65,000	4.2	5,300	F	3.5	5,500	F
	F	*Downtown Tunnel Area (5 segments)*							
Freeway	F1	Downtown Tunnel (I-264 from Portsmouth to I-464)	39,800				18.9	3,600	C
Freeway	F2	Berkley Bridge (I-264 from Waterside to I-464)	104,200				23.8	9,400	C
Two-Lane	F3	Jordan Bridge(Poindexter from Portsmouth to I-464)	34,600				-		F
Arterial	F4	Effingham St, I-264 to South St	24,400	10.0	2,400	F	10.0	2,400	F
Arterial	F5	Frederick Blvd, I-264 to Turnpike Rd	40,700	3.5	4,100	F	3.5	4,100	F

Project Scenario 3

Planning Analysis		Segments	ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
	G	*I-64 (on the Peninsula) (5 segments)*							
Freeway	G1	New Kent County Line to Route 30 (Exit 227)	9,600				3.5	900	A
Freeway	G2	Route 30 (Exit 220) to Croaker Rd (Exit 231)	67,800				24.7	6,100	C
Freeway	G3	Croaker Rd (Exit 231) to Route 199 @ Lightfoot (Exit 234)	81,900				32.2	7,400	D
Freeway	G4	Route 199 @ Lightfoot (Exit 234) to Camp Peary Rd (Exit 238)	72,900				27.1	6,600	D
Freeway	G5	Camp Peary Rd (Exit 238) to Route 199 @ Kingsmill (Exit 242)	77,100				29.4	6,900	D
	H	*I-264 (4 segments)*							
Freeway	H1	Witchduck Rd to Independence Blvd	218,000				*	19,600	F
Freeway	H2	Independence Blvd to Rosemont Rd	177,600				38.4	16,000	E
Freeway	H3	Rosemont Rd to Lynnhaven Pkwy	150,700				28.3	13,600	D
Freeway	H4	First Colonial Rd to proposed Southeastern Pkwy	63,900				15.3	5,800	B
	I	*Dam Neck Rd (2 segments)*							
Arterial	I1	Holland Rd to London Bridge Ext	42,400				15.4	3,800	F
Arterial	I2	Proposed Southeastern Pkwy to Gen Booth Blvd	28,200				21.6	2,500	D
	J	*Birdneck Rd (2 segments)*							
Arterial	J1	I-264 to VA Beach Blvd	27,100				14.3	2,400	E
Arterial	J2	Gen Booth Blvd to Norfolk Ave	9,800				28.2	900	B
	K	*Battlefield Blvd (2 segments)*							
Arterial	K1	Great Bridge Bypass to Volvo Pkwy	49,300	23.1	3,400	D	23.1	4,000	D
Arterial	K2	Cedar Rd to Mt Pleasant Rd	42,300	11.9	2,800	F	6.4	3,100	F
	L	*Kempsville Rd (2 segments)*							
Arterial	L1	Centreville Tpk to Indian River Rd	33,800	16.1	2,500	E	14.3	3,000	F
Arterial	L2	Great Bridge Bypass to Greenbrier Pkwy	39,400	24.4	2,900	D	23.0	3,800	D
	M	*Indian River Rd (2 segments)*							
Arterial	M1	I-64 to Centreville Tpk	101,900				3.2	9,200	F
Arterial	M2	Independence Blvd to Elbow Rd	18,500				29.9	1,700	C
	N	*Oceana Blvd (2 segments)*							
Arterial	N1	Gen Booth Blvd to Tomcat Blvd/proposed Southeastern Pkwy	38,200				7.4	3,400	F
Arterial	N2	Tomcat Blvd/proposed Southeastern Pkwy to VA Beach Blvd	39,500				27.2	3,600	C
	BUILD SCENARIO - ALL ABOVE SEGMENTS, PLUS:								
	O	*Hampton Roads Crossing Segment 1 (2 segments)*							
Freeway	O1	Proposed EW Conn., I-564 to Hampton Blvd							
Freeway	O2	Proposed EW Conn., Hampton Blvd to I-664							
	P	*Hampton Roads Crossing (4 segments)*							
	P1/O1	Proposed EW Conn., I-564 to Hampton Blvd							
	P2	Proposed EW Conn., Hampton Blvd to Craney Island Conn.							
	P3	Proposed EW Conn., Craney Island Conn. to I-664							
	P4	Proposed Craney Island Conn.							
	Q	*Midtown Tunnel and MLK Frwy Extension (1 segment)*							
	Q1	MLK Frwy, I-264 to High St							

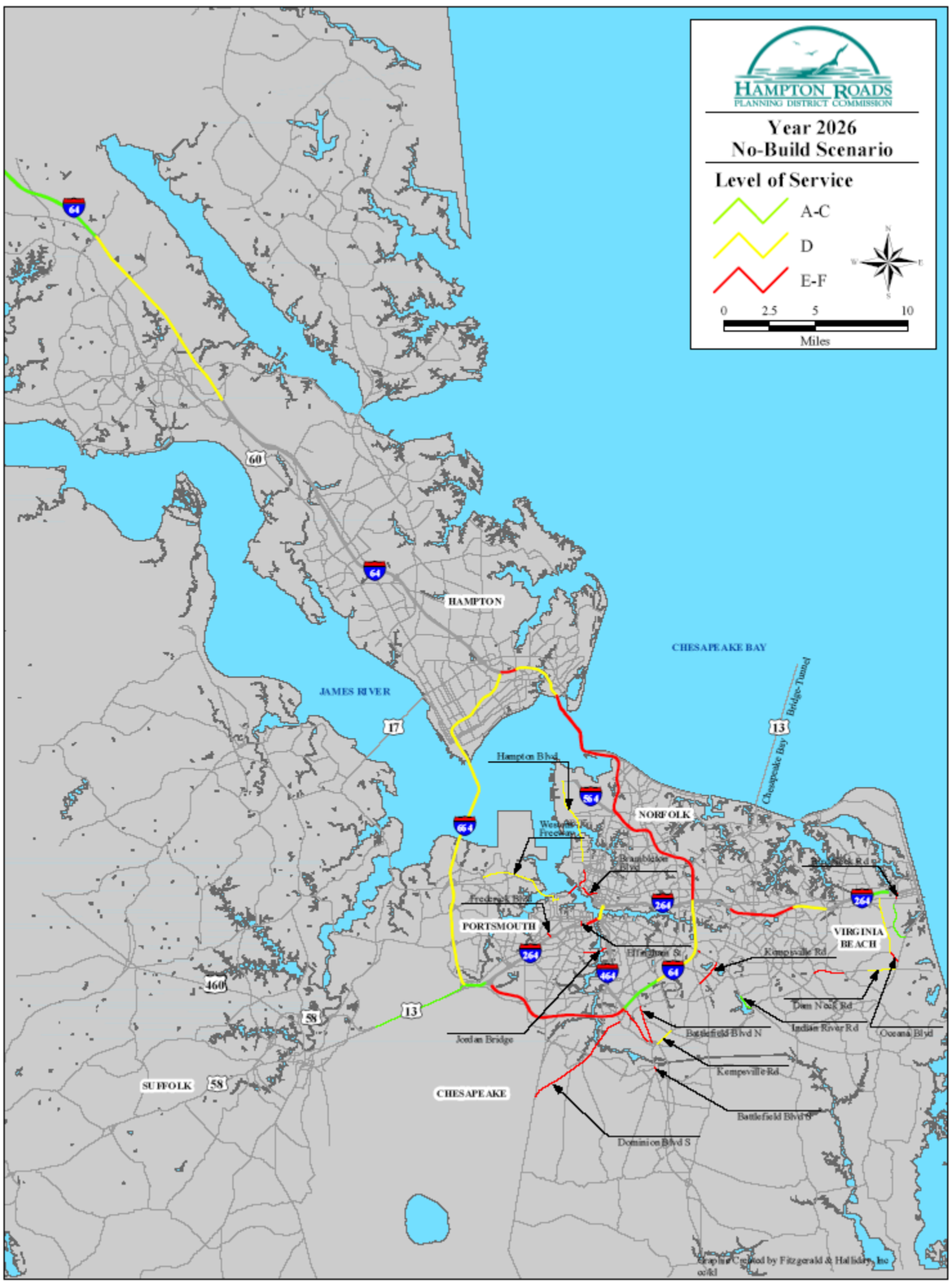
Planning Analysis	Segments	Project Scenario 3 ADT	AM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	AM Peak Hour Calc. Volume	AM Peak Hour LOS (HCS)	PM Peak Hour Criteria (Density[4]) (Avg Travel Speed[5])	PM Peak Hour Calc. Volume	PM Peak Hour LOS (HCS)
R	*New Alignment Route 460 (4 segments)*							
R1	Route 58 Bypass to Windsor town limits							
R2	Windsor town limits to Ivor							
R3	Ivor to Wakefield							
R4	Wakefield to Waverly							
R5	Waverly to Route 625							
R6	Route 625 to Route 156							
R7	Route 156 to I-295							
S	*Southeastern Parkway (6 segments)*							
S1	Great Bridge Bypass to Centreville Tpk							
S2	Centreville Tpk to Indian River Rd							
S3	Indian River Rd to Princess Anne Rd							
S4	Princess Anne Rd to Dam Neck Rd							
S5	Dam Neck Rd to Oceana Blvd							
S6	Oceana Blvd to I-264							

LEVEL OF SERVICE	A	B	C	D	E	F
FREEWAY (Density pc/mi/ln)	0-11	> 11-18	> 18-26	> 26-35	> 35-45	>45
ARTERIAL - CLASS 1 (Average Travel Speed mph)	>42	>34-42	>27-34	>21-27	>16-21	<=16
ARTERIAL - CLASS 2 (Average Travel Speed mph)	>35	>28-35	>22-28	>17-22	>13-17	<=13
ARTERIAL - CLASS 3 (Average Travel Speed mph)	>30	>24-30	>18-24	>14-18	>10-14	<=10

Notes*

1. PHF based on data from studies:Norfolk LOS study, Newport etc.
2. K factor based on HRPDC
3. D Factor based on HRPDC & Studies: etc.
4. Density for Freeway Segments (pc/mi/ln)
5. Average Travel Speed for Arterial Segments (mph)

*I-264 Corridor Study completed by URS.
Elbow Road Study completed by FHI.
I-264 Lynnhaven/Great Neck Interchange Study completed by FHI.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PLANNING DISTRICT COMMISSION
Year 2026
No-Build Scenario
Level of Service
A-C
D
E-F
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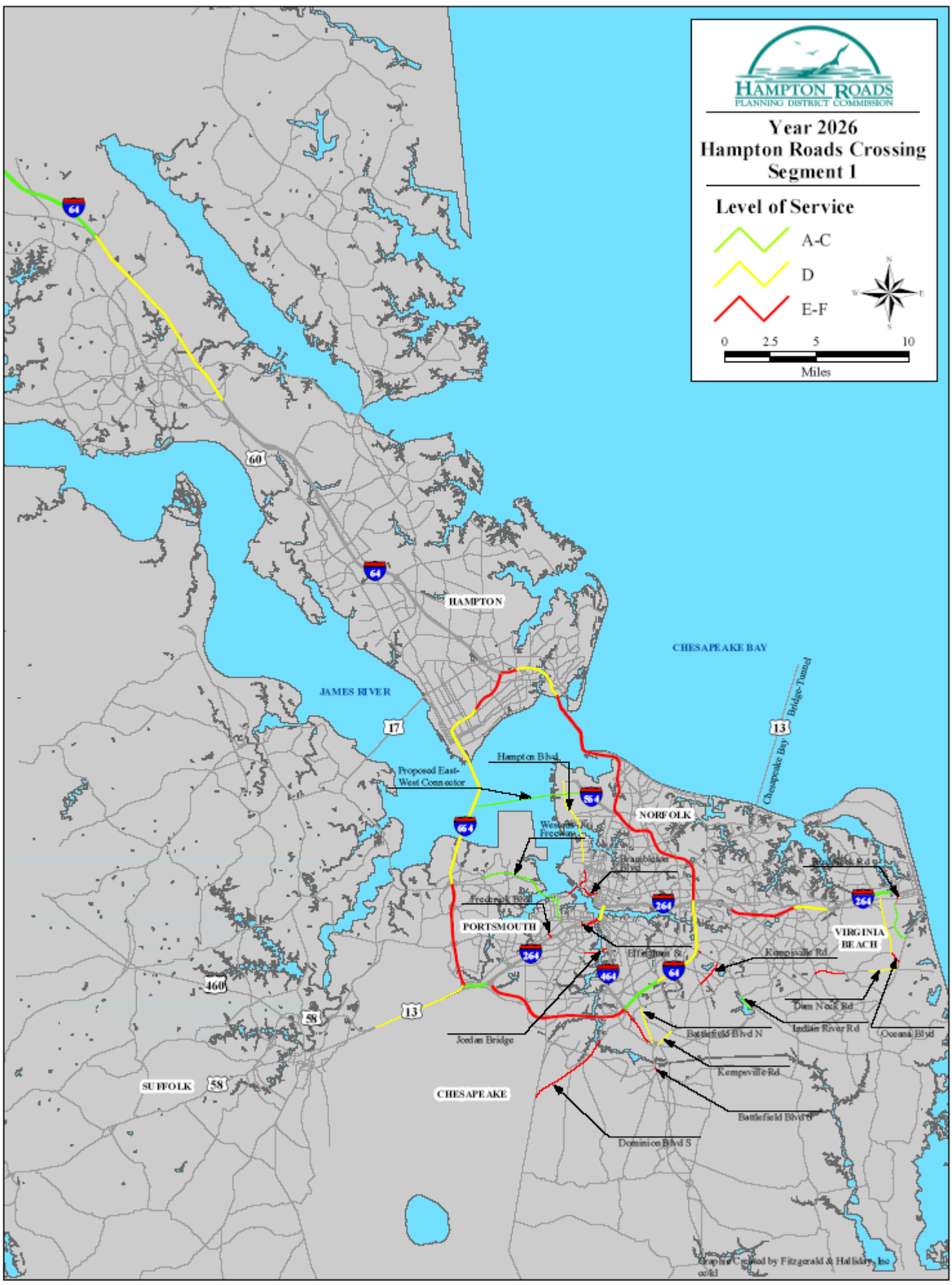
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
SUFFOLK
Hampton Blvd
Frederick Blvd
Jordan Bridge
Chesapeake Bay Bridge-Tunnel
Granby St
Military Hwy
Virginia Beach Blvd
Kempsville Rd
Dam Neck Rd
Indian River Rd
Oceana Blvd
Battlefield Blvd N
Battlefield Blvd S
Dominion Blvd S
Graphic Created by Fitzgerald & Halliday, Inc
ocfd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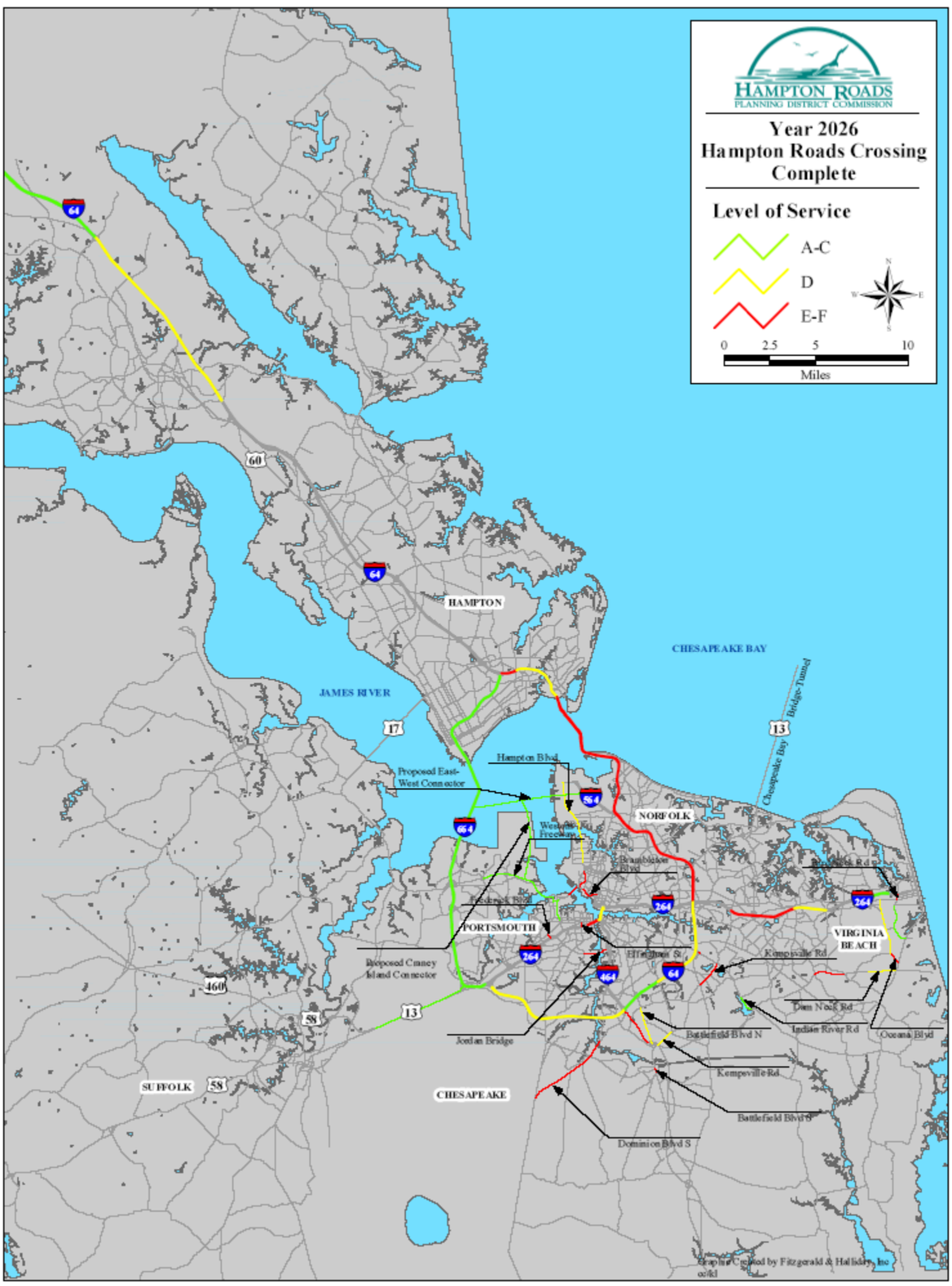
PLANNING DISTRICT COMMISSION
Year 2026
Hampton Roads Crossing
Segment 1
Level of Service
A-C
D
E-F
0 2.5 5 10
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
Hampton Blvd
Proposed East-West Connector
NORFOLK
Brambleton Ave
Freemason St
Granby St
Princess Anne Rd
PORTSMOUTH
VIRGINIA BEACH
Kempsville Rd
Dam Neck Rd
Indian River Rd
Oceana Blvd
Battlefield Blvd N
Jordan Bridge
SUFFOLK
CHESAPEAKE
Battlefield Blvd S
Dominion Blvd S
Graphic Created by Fitzgerald & Halliday, Inc
ocfd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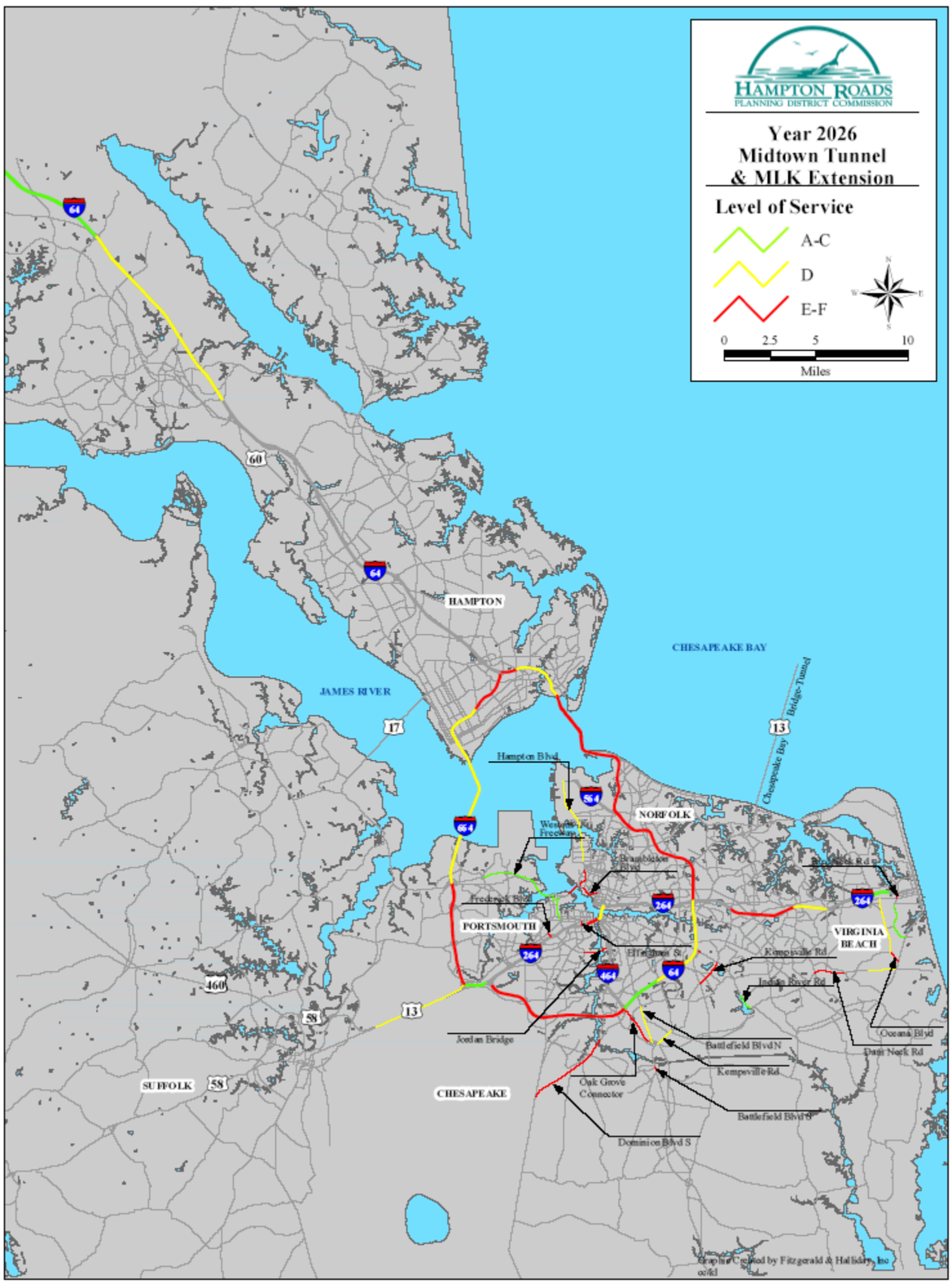
PLANNING DISTRICT COMMISSION
Year 2026
Hampton Roads Crossing
Complete
Level of Service
A-C
D
E-F
0 2.5 5 10
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
Hampton Blvd
Proposed East-West Connector
NORFOLK
Brambleton Blvd
Granby St
PORTSMOUTH
VIRGINIA BEACH
Proposed Craney Island Connector
Jordan Bridge
Kempsville Rd
Dam Neck Rd
Indian River Rd
Oceana Blvd
Battlefield Blvd N
Kempsville Rd
Battlefield Blvd S
Dominion Blvd S
SUFFOLK
CHESAPEAKE
Graphics Created by Fitzgerald & Halliday, Inc
ocbld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PLANNING DISTRICT COMMISSION
Year 2026
Midtown Tunnel
& MLK Extension
Level of Service
A-C
D
E-F
0 2.5 5 10
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
SUFFOLK
Hampton Blvd
Jordan Bridge
Oak Grove Connector
Dominion Blvd S
Battlefield Blvd N
Battlefield Blvd S
Kempsville Rd
Indian River Rd
Oceana Blvd
Dam Neck Rd
Graphic Created by Fitzgerald & Halliday, Inc
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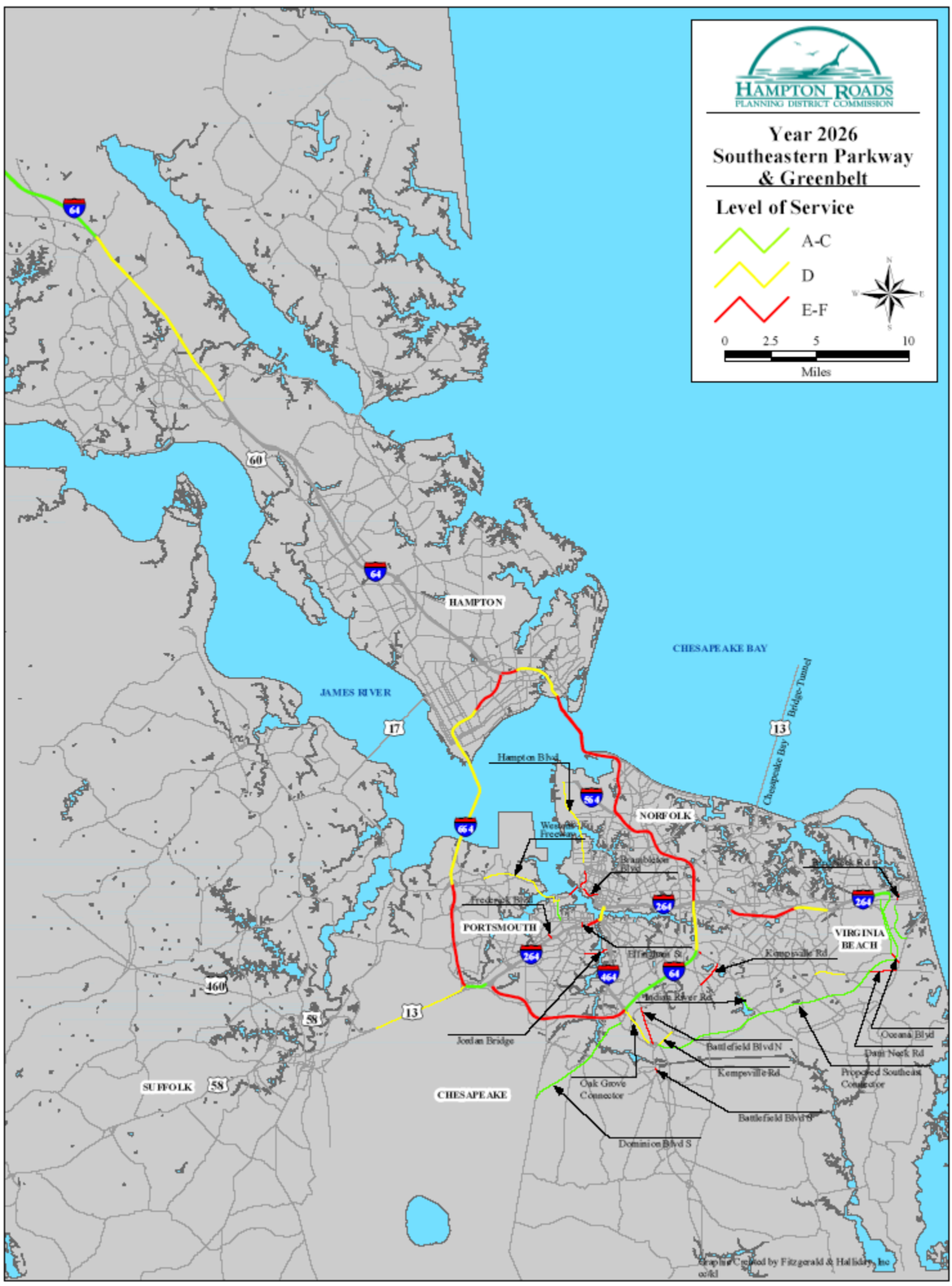
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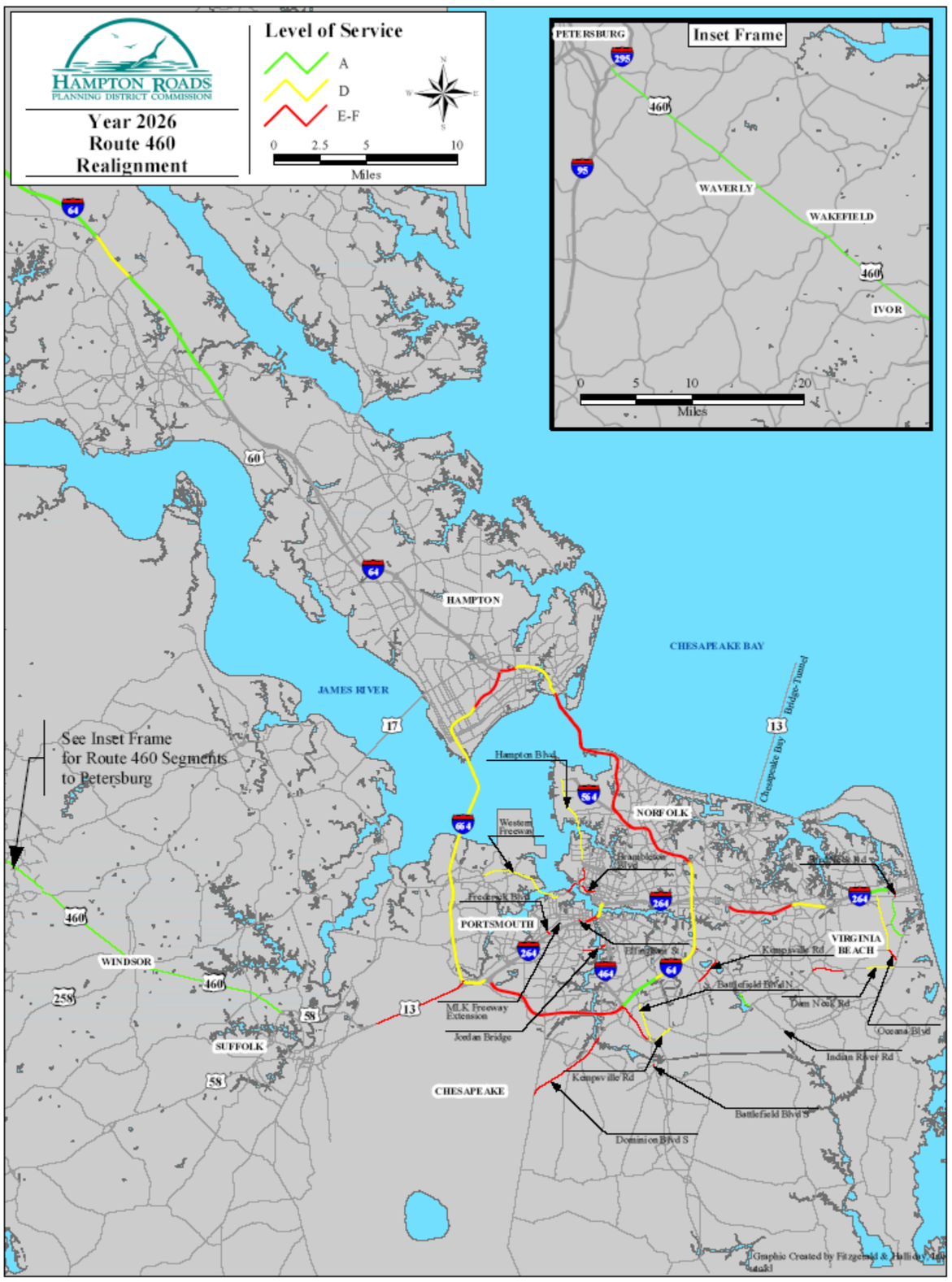
PLANNING DISTRICT COMMISSION
Year 2026
Southeastern Parkway
& Greenbelt
Level of Service
A-C
D
E-F
0 2.5 5 10
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
SUFFOLK
Hampton Blvd
Jordan Bridge
Oak Grove Connector
Dominion Blvd S
Battlefield Blvd N
Battlefield Blvd S
Kempsville Rd
Indian River Rd
Oceana Blvd
Dam Neck Rd
Proposed Southeast Connector
Chesapeake Bay Bridge-Tunnel
Graphics Created by Fitzgerald & Halliday, Inc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A
D
E-F
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Miles
Inset Frame
PETERSBURG
WAVERLY
WAKEFIELD
IVOR
0 5 10 20
Miles
See Inset Frame
for Route 460 Segments
to Petersburg
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
SUFFOLK
WINDSOR
Hampton Blvd
Western Freeway
Frederick Blvd
MLK Freeway Extension
Jordan Bridge
Kempsville Rd
Battlefield Blvd N
Battlefield Blvd S
Dominion Blvd S
Indian River Rd
Oceana Blvd
Chesapeake Bay Bridge-Tunnel
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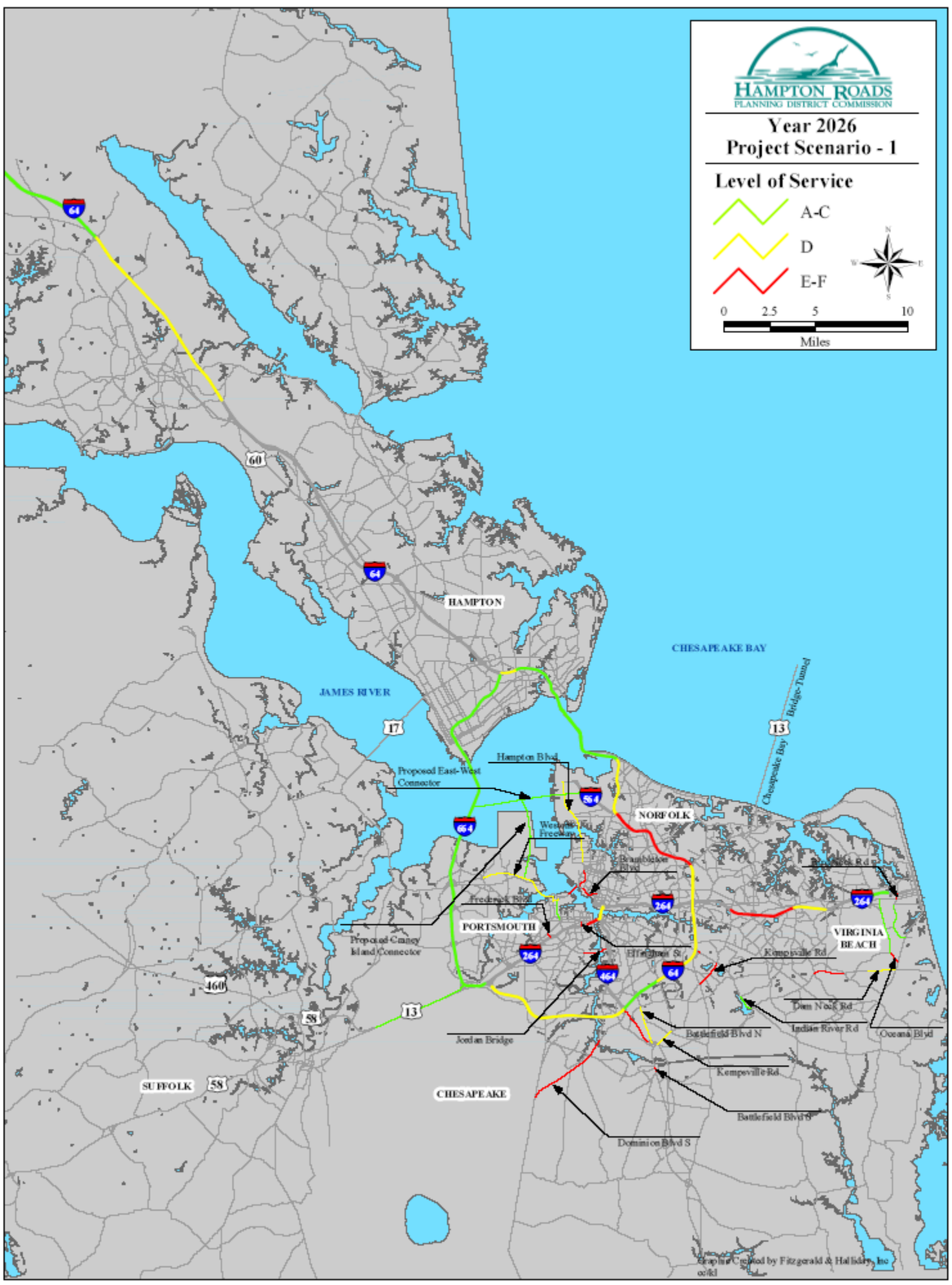
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PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario - 1
Level of Service
A-C
D
E-F
0 2.5 5 10
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
Hampton Blvd
Proposed East-West Connector
NORFOLK
Brambleton Ave
Granby St
Frederick Blvd
PORTSMOUTH
Proposed Caney Island Connector
Hampton Blvd
Kempsville Rd
VIRGINIA BEACH
Dam Neck Rd
Indian River Rd
Oceana Blvd
Battlefield Blvd N
Kempsville Rd
Battlefield Blvd S
Dominion Blvd S
Jordan Bridge
SUFFOLK
CHESAPEAKE
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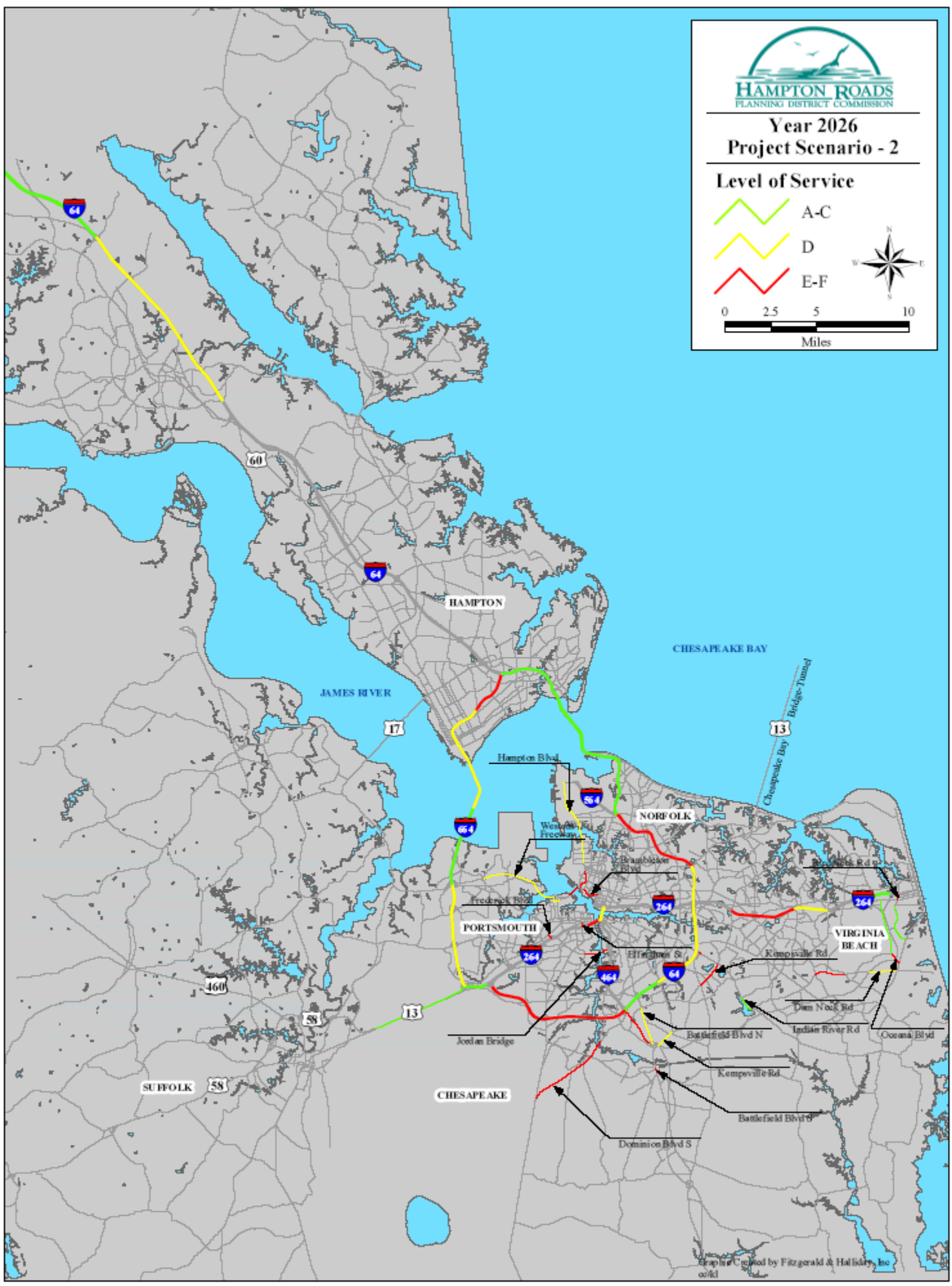
64
60
17
13
58
460
264
464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PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario - 2
Level of Service
A-C
D
E-F
0 2.5 5 10
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
SUFFOLK
Hampton Blvd
Jordan Bridge
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Dam Neck Rd
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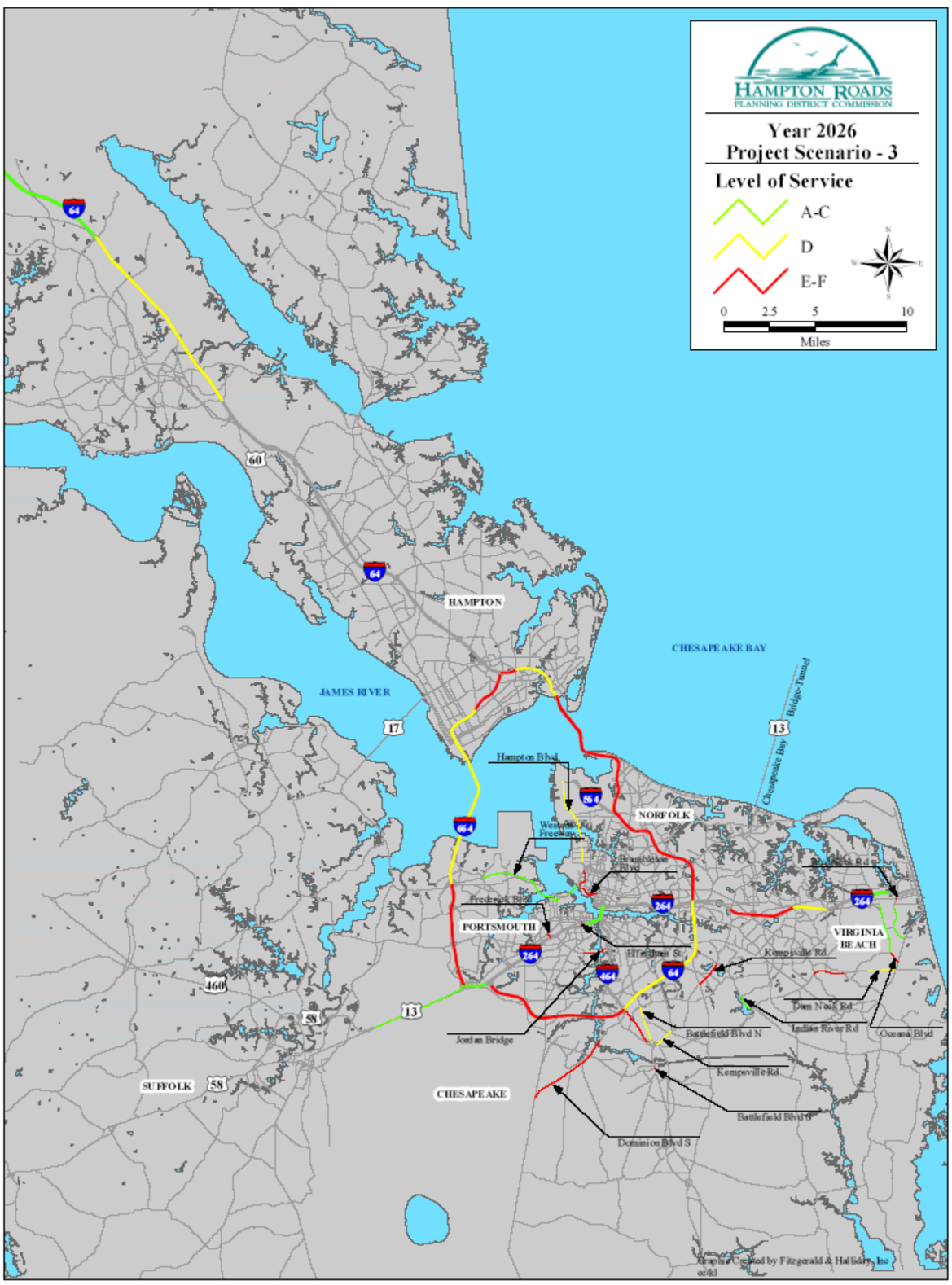
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Year 2026
Project Scenario - 3
Level of Service
A-C
D
E-F
0 2.5 5 10
Miles
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
SUFFOLK
Hampton Blvd
Frederick Blvd
Jordan Bridge
Chesapeake Bay Bridge-Tunnel
Granby St
Hampton Blvd
Kempsville Rd
Dam Neck Rd
Indian River Rd
Oceana Blvd
Battlefield Blvd N
Battlefield Blvd S
Dominion Blvd S
64
264
464
460
58
13
17
60

Toll Feasibility Study
Appendix H
Revenue Optimized Tolls – Travel Patterns

Note: Definition of Project Scenarios:

Features	Project Scenario #1	Project Scenario #2	Project Scenario #3
Projects	• HRX	• Improved HRBT (1)	• Midtown & MLK
Existing/Unimproved, Tolled Roadways	• MMMBT • JRB • HRBT	• MMMBT • JRB • HRBT	• Downtown Tunnel

(2) Hampton Roads Crossing Study, Alternative #1
MMMBT – Monitor Merrimac Bridge Tunnel
JRB – James River Bridge
HRBT – Hampton Roads Bridge Tunnel

Table H-1 Daily Travel Pattern – No Project

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	148,431	44,148	27,401	13,387	33,083	1,575	586	1,894	1,078	12	50	71	105	0	271,820
Norfolk	16,135	158,210	7,365	1,226	37,042	204	599	840	1,339	13	64	81	106	0	223,223
Portsmouth	21,277	16,915	39,175	7,715	3,947	1,057	90	1,304	717	8	45	54	73	0	92,379
Suffolk	15,610	6,047	8,353	57,799	2,371	5,664	55	3,203	1,611	21	92	122	181	3	101,133
Virginia Beach	63,196	123,746	8,727	3,090	354,912	432	16,144	818	944	12	27	35	82	0	572,164
Isle of Wight	1,417	759	807	4,116	259	26,439	7	2,939	1,427	20	77	99	163	5	38,534
Va Bch Waterfront	1,153	3,171	218	71	17,554	12	6,597	23	27	1	0	0	2	0	28,828
Newport News	1,789	3,196	997	2,116	548	3,742	12	144,128	38,092	1,029	9,549	13,696	19,260	1,813	239,968
Hampton	1,661	6,872	895	1,497	1,330	2,453	25	44,717	82,527	940	1,712	2,265	4,950	301	152,144
Poquoson	88	325	46	87	67	161	2	4,467	5,194	2,488	398	527	1,825	108	15,784
Williamsburg	2	10	2	3	1	5	0	492	100	5	6,308	3,649	1,777	42	12,396
James City	15	66	9	19	6	38	0	2,847	562	25	15,715	39,584	8,019	166	67,071
York	233	799	125	254	156	470	4	23,198	11,678	1,093	8,894	10,134	21,735	1,633	80,405
Gloucester	1	6	1	2	0	5	0	300	72	4	122	149	277	21,147	22,087
Total	271,010	364,270	94,122	91,381	451,276	42,257	24,119	231,170	145,367	5,671	43,054	70,467	58,554	25,219	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	316,538	49,404	61,376	17,272	103,700	4,575	1,644	10,060	8,932	228	1,744	1,123	1,823	0	578,420
Norfolk	20,550	342,581	10,403	2,635	91,294	1,217	1,055	5,612	7,250	173	733	627	1,175	1	485,306
Portsmouth	30,099	10,486	123,502	8,448	9,312	1,710	311	3,761	3,293	68	421	332	592	0	192,335
Suffolk	9,182	2,813	8,188	59,072	4,991	4,281	155	4,000	3,163	88	606	364	718	16	97,636
Virginia Beach	53,935	95,090	9,525	5,194	849,748	2,191	22,855	6,771	7,582	211	1,554	951	1,602	0	1,057,209
Isle of Wight	1,862	1,293	1,490	3,850	2,095	80,369	72	5,723	4,581	111	707	441	868	51	103,514
Va Bch Waterfront	351	670	165	81	13,896	37	6,557	102	166	3	34	14	29	0	22,106
Newport News	2,322	3,215	1,937	2,145	3,858	3,728	122	492,108	94,534	1,971	10,704	6,288	34,664	1,102	658,700
Hampton	1,411	2,753	1,133	1,113	3,039	1,846	114	63,409	257,071	1,591	2,154	1,347	9,545	439	346,965
Poquoson	318	509	193	273	657	383	15	11,292	13,590	16,455	734	553	6,970	154	52,096
Williamsburg	30	32	17	22	68	28	3	776	226	9	17,917	3,677	3,317	27	26,147
James City	571	895	428	452	1,182	583	22	11,704	4,453	207	53,900	116,099	18,675	567	209,739
York	502	802	372	453	1,031	622	35	39,461	18,788	1,916	15,103	6,711	63,522	402	149,718
Gloucester	75	133	63	62	148	74	2	1,161	598	31	406	253	508	35,115	38,629
Total	437,746	510,675	218,793	101,073	1,085,020	101,643	32,961	655,941	424,228	23,062	106,715	138,781	144,009	37,873	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	110,696	19,739	19,205	5,672	34,164	1,333	346	2,271	1,331	124	194	566	561	131	196,333
Norfolk	19,558	198,192	8,615	1,573	57,519	786	605	1,842	2,198	82	333	884	626	161	292,973
Portsmouth	19,272	8,746	53,711	4,268	5,522	857	96	1,083	743	30	143	356	260	61	95,148
Suffolk	5,849	1,640	4,324	22,866	2,121	2,241	43	1,333	896	40	103	380	263	74	42,176
Virginia Beach	33,865	57,352	5,412	2,034	363,655	1,536	8,366	3,690	2,193	216	231	798	965	229	480,542
Isle of Wight	1,426	852	911	2,323	1,673	33,405	61	2,657	1,755	67	102	446	389	97	46,164
Va Bch Waterfront	345	604	92	41	8,359	56	2,294	112	110	6	8	16	19	7	12,070
Newport News	2,508	2,057	1,198	1,420	4,093	2,642	118	176,229	37,538	1,799	2,278	5,999	16,087	620	254,585
Hampton	1,425	2,339	788	945	2,379	1,794	125	37,304	111,291	1,941	528	1,342	6,772	446	169,419
Poquoson	139	87	32	44	237	79	6	1,783	1,951	2,871	51	126	1,191	38	8,633
Williamsburg	226	379	162	114	264	109	9	2,381	563	55	14,372	11,387	4,744	101	34,866
James City	649	995	404	422	913	477	18	6,206	1,425	134	11,398	65,176	7,324	388	95,929
York	622	707	288	283	1,078	401	21	16,267	6,878	1,214	4,719	7,277	22,637	200	62,593
Gloucester	151	214	90	100	230	141	6	808	286	37	112	294	485	13,477	16,429
Total	196,730	293,902	95,233	42,107	482,208	45,858	12,113	253,964	169,159	8,616	34,571	95,047	62,323	16,029	1,807,860

Table H-2 Daily Travel Pattern – Hampton Roads Crossing, Segment I

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	159,944	43,340	27,193	12,719	24,327	1,270	343	1,594	992	8	23	19	48	0	271,820
Norfolk	14,463	167,810	6,908	1,530	29,016	242	357	1,350	1,412	10	28	31	65	0	223,223
Portsmouth	20,837	17,005	41,064	7,900	2,712	887	47	1,141	696	6	21	23	42	0	92,379
Suffolk	13,694	8,900	8,309	58,242	1,501	5,627	27	2,941	1,627	15	56	78	117	0	101,133
Virginia Beach	57,421	109,562	7,872	2,740	375,526	345	17,029	853	788	6	0	0	21	0	572,164
Isle of Wight	1,106	962	700	4,134	154	27,520	3	2,443	1,308	13	41	57	93	1	38,534
Va Bch Waterfront	870	2,618	159	51	18,653	8	6,431	19	21	0	0	0	0	0	28,828
Newport News	1,398	6,044	892	2,000	456	3,148	6	149,796	33,044	654	9,258	13,662	17,983	1,627	239,968
Hampton	1,597	8,111	1,007	1,725	990	2,517	14	41,882	88,431	645	812	1,109	3,165	140	152,144
Poquoson	89	369	51	99	49	160	0	3,931	5,266	3,374	258	349	1,693	97	15,784
Williamsburg	1	3	0	1	0	2	0	340	33	1	6,701	3,437	1,845	31	12,396
James City	3	15	1	8	0	16	0	2,178	217	9	15,704	40,743	8,033	145	67,071
York	167	753	104	215	87	355	1	21,301	11,346	930	9,315	9,562	24,554	1,715	80,405
Gloucester	0	1	0	1	0	2	0	279	50	3	154	175	296	21,126	22,087
Total	271,589	365,493	94,260	91,366	453,471	42,100	24,257	230,047	145,230	5,673	42,371	69,244	57,954	24,882	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	316,540	49,420	61,378	17,270	103,704	4,573	1,644	10,046	8,928	228	1,744	1,123	1,823	0	578,420
Norfolk	20,540	342,373	10,392	2,643	91,244	1,233	1,054	5,855	7,266	173	732	627	1,173	1	485,306
Portsmouth	30,100	10,488	123,506	8,447	9,313	1,709	311	3,756	3,291	68	421	332	592	0	192,335
Suffolk	9,181	2,828	8,187	59,067	4,992	4,279	155	3,995	3,161	88	606	364	718	16	97,636
Virginia Beach	53,931	95,099	9,524	5,193	849,697	2,190	22,851	6,829	7,577	211	1,553	951	1,601	0	1,057,209
Isle of Wight	1,862	1,306	1,491	3,850	2,096	80,362	72	5,717	4,580	111	707	441	868	51	103,514
Va Bch Waterfront	351	670	165	81	13,895	37	6,556	104	166	3	34	14	29	0	22,106
Newport News	2,323	3,316	1,938	2,146	3,907	3,728	125	491,948	94,533	1,972	10,706	6,289	34,667	1,102	658,700
Hampton	1,411	2,763	1,134	1,113	3,041	1,846	114	63,359	257,102	1,591	2,155	1,348	9,548	440	346,965
Poquoson	318	509	194	274	658	383	15	11,289	13,590	16,456	734	553	6,970	154	52,096
Williamsburg	30	32	17	22	68	28	3	775	226	9	17,917	3,677	3,317	27	26,147
James City	571	897	428	452	1,183	583	22	11,700	4,452	207	53,901	116,101	18,675	567	209,739
York	503	803	372	453	1,031	622	35	39,457	18,786	1,916	15,103	6,711	63,525	402	149,718
Gloucester	75	133	63	62	148	74	2	1,161	598	31	406	253	508	35,115	38,629
Total	437,735	510,638	218,789	101,073	1,084,975	101,647	32,960	655,991	424,258	23,063	106,718	138,784	144,015	37,874	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	110,720	19,736	19,204	5,641	34,162	1,333	346	2,280	1,334	124	194	567	562	131	196,333
Norfolk	19,589	197,217	8,667	1,819	57,470	838	605	2,303	2,336	90	374	903	606	157	292,973
Portsmouth	19,270	8,779	53,714	4,235	5,521	856	96	1,082	744	30	143	357	260	62	95,148
Suffolk	5,809	1,888	4,286	22,727	2,114	2,232	43	1,326	893	40	103	379	263	74	42,176
Virginia Beach	33,869	57,224	5,414	2,031	363,770	1,538	8,378	3,670	2,203	216	231	799	967	230	480,542
Isle of Wight	1,423	903	909	2,311	1,670	33,383	61	2,651	1,754	67	102	446	389	97	46,164
Va Bch Waterfront	345	603	93	41	8,368	56	2,297	104	107	6	8	16	19	7	12,070
Newport News	2,508	2,608	1,192	1,408	4,044	2,632	108	175,878	37,424	1,796	2,276	6,003	16,088	620	254,585
Hampton	1,423	2,481	786	939	2,380	1,790	121	37,216	111,256	1,940	528	1,341	6,771	447	169,419
Poquoson	138	96	32	44	236	79	6	1,780	1,950	2,866	51	125	1,191	38	8,633
Williamsburg	225	424	162	114	264	109	9	2,379	563	55	14,345	11,377	4,739	101	34,866
James City	648	1,015	404	420	912	477	18	6,211	1,426	134	11,390	65,159	7,327	389	95,929
York	621	682	288	282	1,077	401	21	16,273	6,882	1,214	4,715	7,279	22,655	200	62,593
Gloucester	150	226	90	99	229	141	6	805	285	37	111	293	484	13,474	16,429
Total	196,738	293,883	95,240	42,112	482,216	45,863	12,114	253,958	169,156	8,615	34,571	95,045	62,321	16,028	1,807,860

Table H-3 Daily Travel Pattern – Hampton Roads Crossing

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	161,471	43,145	27,226	12,469	24,235	1,212	344	1,088	564	5	14	13	35	0	271,820
Norfolk	14,458	167,780	7,179	1,470	29,078	248	365	1,321	1,203	8	25	28	59	0	223,223
Portsmouth	20,543	18,363	41,049	7,436	2,839	859	49	803	381	4	13	12	29	0	92,379
Suffolk	13,305	8,503	8,356	59,706	1,440	5,578	26	2,678	1,336	12	46	52	93	0	101,133
Virginia Beach	57,452	109,936	8,045	2,650	375,220	309	17,021	833	672	5	0	0	18	0	572,164
Isle of Wight	1,056	1,018	704	4,030	144	27,816	2	2,392	1,205	12	34	43	78	1	38,534
Va Bch Waterfront	871	2,667	165	51	18,622	7	6,409	19	18	0	0	0	0	0	28,828
Newport News	1,018	5,426	712	1,726	440	3,080	5	151,816	32,634	641	9,379	13,566	17,881	1,644	239,968
Hampton	935	7,409	605	1,418	910	2,459	14	41,498	90,549	661	923	1,235	3,375	152	152,144
Poquoson	55	283	35	83	46	153	0	3,970	5,308	3,393	271	362	1,724	102	15,784
Williamsburg	0	2	0	1	0	2	0	335	33	1	6,699	3,450	1,845	29	12,396
James City	2	9	1	5	0	14	0	2,211	225	9	15,552	40,883	8,017	143	67,071
York	112	586	80	178	75	346	0	21,360	11,316	926	9,392	9,619	24,649	1,765	80,405
Gloucester	0	0	0	1	0	2	0	276	50	3	154	174	295	21,132	22,087
Total	271,278	365,127	94,158	91,223	453,049	42,085	24,236	230,600	145,494	5,681	42,503	69,437	58,098	24,968	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	319,418	49,977	61,740	15,636	104,717	4,128	1,652	8,564	8,059	212	1,582	1,004	1,732	0	578,420
Norfolk	20,528	342,387	10,340	2,613	91,291	1,229	1,056	5,762	7,366	175	740	632	1,186	1	485,306
Portsmouth	30,106	10,554	123,995	8,456	9,370	1,709	314	3,476	2,918	78	451	333	575	0	192,335
Suffolk	7,948	2,761	8,044	61,057	4,401	4,372	130	3,958	3,180	82	600	365	724	14	97,636
Virginia Beach	53,734	95,129	9,464	4,716	850,514	1,896	22,894	6,784	7,715	214	1,570	960	1,619	0	1,057,209
Isle of Wight	1,598	1,244	1,456	3,936	1,835	80,807	61	5,773	4,618	111	710	442	872	50	103,514
Va Bch Waterfront	343	670	164	68	13,909	29	6,570	103	169	3	35	15	30	0	22,106
Newport News	1,955	3,214	1,772	2,142	3,792	3,774	121	493,518	93,770	1,958	10,698	6,283	34,611	1,092	658,700
Hampton	1,195	2,723	914	1,112	3,005	1,865	113	62,871	258,145	1,588	2,148	1,340	9,509	437	346,965
Poquoson	296	503	194	263	650	386	15	11,275	13,657	16,452	732	551	6,969	153	52,096
Williamsburg	26	32	17	22	67	28	3	778	228	9	17,919	3,675	3,315	27	26,147
James City	500	887	418	461	1,172	589	22	11,738	4,476	208	53,929	116,100	18,674	565	209,739
York	459	793	346	457	1,020	628	34	39,456	18,852	1,917	15,104	6,708	63,544	399	149,718
Gloucester	63	133	62	63	148	75	2	1,168	604	31	408	254	511	35,108	38,629
Total	438,170	511,008	218,924	101,004	1,085,891	101,513	32,987	655,225	423,755	23,038	106,626	138,661	143,872	37,844	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	111,424	19,851	19,240	5,202	34,202	1,256	346	2,069	1,231	130	188	539	525	133	196,333
Norfolk	19,712	197,208	8,907	1,714	57,467	802	605	2,202	2,271	82	357	866	627	154	292,973
Portsmouth	19,303	9,022	53,809	4,195	5,523	823	96	976	556	33	135	358	256	62	95,148
Suffolk	5,362	1,787	4,259	23,495	1,922	2,271	34	1,299	878	40	106	385	265	74	42,176
Virginia Beach	33,925	57,234	5,416	1,832	363,907	1,530	8,377	3,675	2,204	216	231	799	967	230	480,542
Isle of Wight	1,340	867	876	2,353	1,672	33,458	54	2,670	1,767	67	103	448	391	97	46,164
Va Bch Waterfront	344	603	93	32	8,370	51	2,298	113	110	6	8	16	19	7	12,070
Newport News	2,281	2,506	1,061	1,383	4,071	2,651	122	176,713	37,020	1,787	2,277	6,010	16,081	623	254,585
Hampton	1,341	2,420	604	918	2,386	1,799	125	36,806	111,989	1,944	528	1,342	6,770	447	169,419
Poquoson	144	87	33	43	236	78	6	1,777	1,955	2,868	51	125	1,190	38	8,633
Williamsburg	211	407	154	117	264	109	9	2,382	565	55	14,361	11,387	4,744	101	34,866
James City	613	973	406	425	914	477	18	6,219	1,433	135	11,397	65,195	7,335	389	95,929
York	591	704	284	283	1,078	401	21	16,251	6,892	1,216	4,719	7,284	22,668	200	62,593
Gloucester	149	220	90	100	229	141	6	808	286	37	111	293	484	13,474	16,429
Total	196,740	293,890	95,233	42,092	482,241	45,846	12,114	253,960	169,158	8,616	34,572	95,047	62,322	16,029	1,807,860

Table H-4 Daily Travel Pattern – Midtown Tunnel & MLK Extension

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	159,896	43,280	27,128	12,438	24,726	1,243	354	1,634	1,015	9	25	22	51	0	271,820
Norfolk	13,281	173,701	4,941	825	28,275	126	357	585	1,039	7	16	21	48	0	223,223
Portsmouth	21,615	14,055	42,949	8,012	2,729	905	47	1,220	747	6	24	25	46	0	92,379
Suffolk	14,826	5,222	9,086	59,373	1,595	5,739	30	3,207	1,759	16	63	87	129	0	101,133
Virginia Beach	55,814	114,236	6,868	2,318	374,525	289	16,967	494	633	5	0	0	16	0	572,164
Isle of Wight	1,162	557	740	4,165	160	27,644	3	2,542	1,344	13	44	61	99	1	38,534
Va Bch Waterfront	846	2,815	137	44	18,553	7	6,397	12	18	0	0	0	0	0	28,828
Newport News	1,542	2,403	996	2,108	305	3,256	3	151,905	33,783	656	9,400	13,867	18,094	1,649	239,968
Hampton	1,663	7,245	1,063	1,745	961	2,513	15	42,043	88,915	649	838	1,145	3,205	143	152,144
Poquoson	93	297	52	97	49	155	0	3,946	5,257	3,393	267	361	1,716	99	15,784
Williamsburg	1	1	0	1	0	2	0	328	32	1	6,723	3,435	1,842	30	12,396
James City	3	5	1	7	0	15	0	2,136	210	9	15,690	40,831	8,018	145	67,071
York	168	569	106	213	82	351	0	21,169	11,219	933	9,406	9,643	24,750	1,795	80,405
Gloucester	0	0	0	1	0	2	0	269	48	3	153	173	291	21,148	22,087
Total	270,910	364,388	94,067	91,348	451,959	42,249	24,174	231,491	146,018	5,700	42,649	69,671	58,304	25,010	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	316,465	48,734	62,103	17,311	103,638	4,588	1,646	10,071	8,942	228	1,745	1,124	1,826	0	578,420
Norfolk	20,109	347,622	5,859	2,302	91,696	996	1,060	5,654	7,284	174	737	631	1,181	1	485,306
Portsmouth	30,606	6,076	127,215	8,578	9,147	1,746	321	3,839	3,362	70	432	339	605	0	192,335
Suffolk	9,194	2,544	8,255	59,195	5,011	4,299	156	4,013	3,172	88	608	365	720	16	97,636
Virginia Beach	53,848	95,620	9,375	5,185	849,511	2,189	22,840	6,760	7,568	211	1,552	950	1,599	0	1,057,209
Isle of Wight	1,865	1,090	1,507	3,867	2,104	80,499	72	5,735	4,590	111	709	442	871	51	103,514
Va Bch Waterfront	351	675	167	81	13,896	37	6,551	102	166	3	34	14	29	0	22,106
Newport News	2,319	3,247	1,955	2,144	3,862	3,734	122	492,065	94,516	1,971	10,706	6,290	34,664	1,103	658,700
Hampton	1,409	2,779	1,141	1,112	3,043	1,849	114	63,402	257,034	1,591	2,155	1,348	9,547	440	346,965
Poquoson	318	513	195	273	658	383	15	11,291	13,585	16,455	734	553	6,969	154	52,096
Williamsburg	30	33	17	22	68	28	3	775	226	9	17,916	3,678	3,317	27	26,147
James City	570	904	433	452	1,183	583	22	11,699	4,450	207	53,894	116,102	18,673	568	209,739
York	502	809	376	453	1,032	622	35	39,457	18,782	1,916	15,102	6,712	63,519	402	149,718
Gloucester	75	135	63	62	148	74	2	1,160	597	31	406	253	507	35,116	38,629
Total	437,661	510,779	218,660	101,037	1,084,998	101,626	32,960	656,022	424,275	23,065	106,731	138,802	144,028	37,878	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	110,736	19,270	19,578	5,717	34,151	1,339	346	2,278	1,337	124	195	568	563	131	196,333
Norfolk	19,056	201,374	5,878	1,303	57,809	798	609	1,837	2,211	82	334	890	630	162	292,973
Portsmouth	19,727	5,957	56,060	4,365	5,332	880	89	1,108	760	32	147	363	266	63	95,148
Suffolk	5,894	1,371	4,407	22,972	2,131	2,252	43	1,340	900	41	104	382	265	74	42,176
Virginia Beach	33,779	57,706	5,221	2,032	363,584	1,533	8,369	3,688	2,192	216	231	798	965	229	480,542
Isle of Wight	1,429	867	928	2,327	1,672	33,358	61	2,661	1,758	67	102	446	389	97	46,164
Va Bch Waterfront	344	609	88	41	8,361	56	2,295	112	110	6	8	16	19	7	12,070
Newport News	2,507	2,048	1,214	1,420	4,094	2,642	118	176,223	37,536	1,799	2,278	6,000	16,086	620	254,585
Hampton	1,426	2,357	799	945	2,380	1,794	125	37,298	111,268	1,941	528	1,342	6,772	447	169,419
Poquoson	139	87	33	44	237	79	6	1,782	1,950	2,870	51	126	1,191	38	8,633
Williamsburg	226	381	165	114	264	109	9	2,381	563	55	14,370	11,386	4,743	101	34,866
James City	648	1,003	408	422	913	476	18	6,204	1,425	134	11,396	65,171	7,323	388	95,929
York	621	713	293	283	1,078	401	21	16,265	6,877	1,214	4,719	7,276	22,633	200	62,593
Gloucester	150	215	92	100	230	141	6	807	286	37	112	294	485	13,475	16,429
Total	196,682	293,958	95,163	42,084	482,236	45,857	12,114	253,984	169,171	8,616	34,576	95,058	62,329	16,031	1,807,860

Table H-5 Daily Travel Pattern – Southeastern Parkway & Greenbelt

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	159,478	42,359	26,522	12,168	26,973	1,221	471	1,558	975	8	22	18	47	0	271,820
Norfolk	12,921	171,734	6,235	1,028	28,987	152	386	613	1,069	8	18	23	50	0	223,223
Portsmouth	20,062	17,040	41,612	7,786	3,000	876	56	1,151	707	6	19	21	42	0	92,379
Suffolk	14,068	6,219	8,975	59,315	1,715	5,698	34	3,107	1,727	16	58	77	124	0	101,133
Virginia Beach	59,108	113,250	7,640	2,579	371,131	325	16,933	526	649	5	0	0	17	0	572,164
Isle of Wight	1,096	672	733	4,197	172	27,611	3	2,501	1,343	13	41	54	96	1	38,534
Va Bch Waterfront	950	2,822	158	51	18,544	7	6,265	12	18	0	0	0	0	0	28,828
Newport News	1,500	2,477	997	2,123	318	3,235	4	151,667	33,980	659	9,378	13,798	18,142	1,689	239,968
Hampton	1,615	7,027	1,087	1,798	978	2,576	15	42,220	88,796	649	849	1,155	3,228	151	152,144
Poquoson	90	289	53	101	50	161	0	3,936	5,251	3,394	263	354	1,733	109	15,784
Williamsburg	1	1	0	1	0	2	0	321	31	1	6,724	3,447	1,840	27	12,396
James City	3	5	1	6	0	14	0	2,121	212	8	15,696	40,844	8,022	138	67,071
York	161	558	108	219	83	362	1	21,372	11,164	929	9,391	9,644	24,637	1,777	80,405
Gloucester	0	0	0	1	0	2	0	272	50	3	152	170	293	21,142	22,087
Total	271,053	364,455	94,122	91,372	451,950	42,242	24,168	231,378	145,971	5,698	42,612	69,607	58,272	25,035	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	317,131	48,916	61,146	17,370	103,313	4,611	1,668	10,181	9,111	226	1,750	1,128	1,870	0	578,420
Norfolk	20,377	342,751	10,407	2,623	91,357	1,213	1,052	5,598	7,228	173	731	625	1,171	1	485,306
Portsmouth	29,912	10,518	123,670	8,442	9,317	1,707	311	3,757	3,288	68	421	332	592	0	192,335
Suffolk	9,167	2,827	8,206	59,032	5,004	4,283	155	4,004	3,164	88	607	364	719	16	97,636
Virginia Beach	53,659	95,277	9,517	5,161	849,933	2,188	22,834	6,764	7,564	211	1,552	950	1,599	0	1,057,209
Isle of Wight	1,854	1,299	1,495	3,846	2,101	80,358	72	5,727	4,583	111	708	442	869	51	103,514
Va Bch Waterfront	351	672	165	81	13,898	37	6,553	102	166	3	34	14	29	0	22,106
Newport News	2,325	3,226	1,942	2,141	3,865	3,726	122	492,107	94,508	1,972	10,709	6,291	34,662	1,103	658,700
Hampton	1,417	2,763	1,136	1,111	3,048	1,845	114	63,419	257,033	1,592	2,155	1,348	9,545	440	346,965
Poquoson	322	510	194	273	659	383	15	11,289	13,585	16,458	734	553	6,967	154	52,096
Williamsburg	30	32	17	22	68	28	3	775	226	9	17,917	3,678	3,317	27	26,147
James City	564	898	429	451	1,185	582	22	11,699	4,450	207	53,903	116,110	18,672	567	209,739
York	506	804	373	452	1,033	621	35	39,459	18,786	1,917	15,105	6,712	63,513	402	149,718
Gloucester	74	134	63	62	149	74	2	1,160	597	31	406	253	507	35,117	38,629
Total	437,689	510,628	218,758	101,068	1,084,929	101,654	32,958	656,042	424,288	23,065	106,730	138,800	144,032	37,877	4,018,520

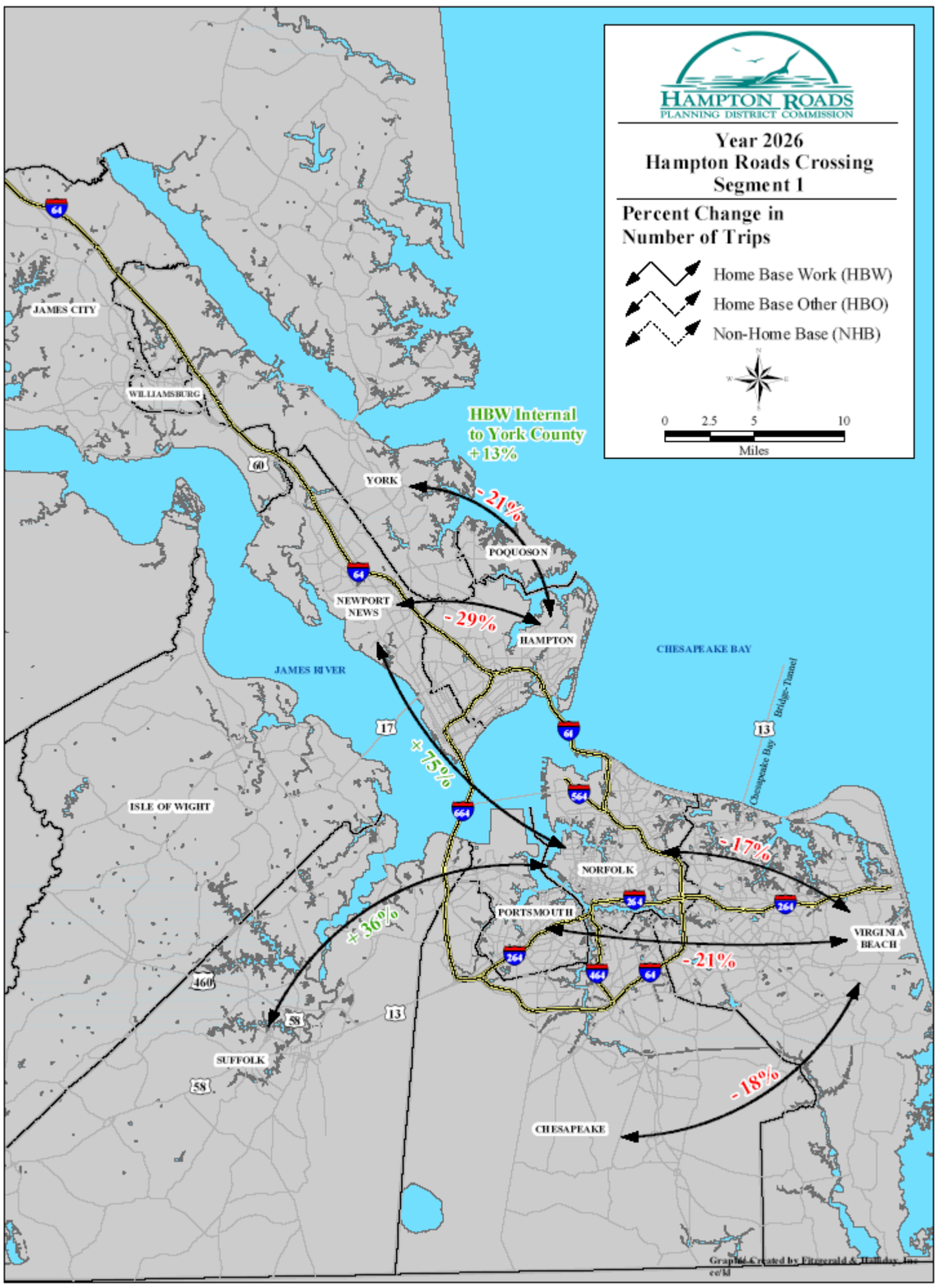
Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	111,238	19,449	19,036	5,652	34,016	1,342	341	2,307	1,337	131	199	577	575	134	196,333
Norfolk	19,266	198,387	8,639	1,576	57,577	788	605	1,845	2,201	82	333	886	627	161	292,973
Portsmouth	19,121	8,765	53,832	4,275	5,522	858	96	1,084	744	30	143	357	260	62	95,148
Suffolk	5,849	1,639	4,325	22,867	2,120	2,243	43	1,332	896	40	103	380	263	74	42,176
Virginia Beach	33,665	57,426	5,422	2,040	363,755	1,534	8,373	3,691	2,195	216	231	799	966	230	480,542
Isle of Wight	1,449	851	911	2,321	1,669	33,394	61	2,654	1,754	67	102	446	389	97	46,164
Va Bch Waterfront	339	605	93	41	8,366	56	2,293	112	110	6	8	16	19	7	12,070
Newport News	2,516	2,056	1,199	1,420	4,085	2,643	118	176,223	37,543	1,798	2,278	6,001	16,086	620	254,585
Hampton	1,452	2,337	788	945	2,375	1,794	124	37,296	111,284	1,939	528	1,342	6,767	446	169,419
Poquoson	137	87	32	44	237	79	6	1,783	1,952	2,869	51	126	1,192	38	8,633
Williamsburg	226	378	162	114	264	109	9	2,381	563	55	14,372	11,387	4,744	101	34,866
James City	661	995	404	422	912	477	18	6,204	1,425	134	11,396	65,169	7,324	388	95,929
York	637	706	288	283	1,077	401	21	16,260	6,878	1,213	4,720	7,277	22,631	200	62,593
Gloucester	153	214	90	100	229	141	6	807	286	37	112	294	485	13,475	16,429
Total	196,709	293,896	95,221	42,102	482,203	45,858	12,113	253,981	169,170	8,616	34,575	95,056	62,328	16,030	1,807,860

Table H-6 Daily Travel Pattern – Route 460 Realignment

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	160,015	43,509	27,248	11,546	25,065	1,102	374	1,714	1,077	9	29	37	62	0	271,787
Norfolk	13,896	170,696	6,115	915	29,035	136	390	697	1,192	9	39	40	64	0	223,223
Portsmouth	21,109	16,177	41,908	7,330	2,836	789	53	1,252	772	6	31	37	53	0	92,353
Suffolk	13,720	5,470	8,388	60,218	1,425	5,718	29	3,149	1,721	16	69	100	134	0	100,157
Virginia Beach	56,572	114,016	7,209	2,118	373,653	247	16,993	582	739	6	0	3	26	0	572,163
Isle of Wight	1,036	575	653	4,304	136	26,684	2	2,487	1,300	13	50	68	102	1	37,411
Va Bch Waterfront	893	2,912	152	43	18,465	5	6,321	15	21	0	0	0	0	0	28,828
Newport News	1,613	2,768	1,057	2,018	366	3,184	5	150,474	34,732	664	9,796	14,369	18,029	872	239,948
Hampton	1,741	7,452	1,095	1,657	1,067	2,403	16	42,505	87,309	648	1,151	1,513	3,497	68	152,122
Poquoson	97	305	56	92	54	152	0	3,962	5,207	3,371	303	413	1,745	27	15,782
Williamsburg	1	4	1	2	0	3	0	397	51	2	6,627	3,487	1,815	8	12,396
James City	6	21	4	11	1	22	0	2,604	328	12	15,595	40,419	8,006	42	67,071
York	182	618	117	214	98	369	1	21,641	11,359	940	9,231	9,716	24,897	1,018	80,402
Gloucester	0	0	0	0	0	2	0	195	40	2	87	105	193	21,462	22,087
Total	270,881	364,523	94,002	90,467	452,203	40,816	24,185	231,673	145,848	5,699	43,008	70,305	58,623	23,498	1,915,731

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	307,337	46,966	59,176	17,824	98,446	5,193	1,538	9,190	8,181	209	1,582	1,014	1,661	0	558,316
Norfolk	20,723	338,346	10,707	2,975	90,095	1,471	1,037	5,456	7,065	169	702	598	1,138	1	480,482
Portsmouth	29,216	9,686	119,904	8,565	8,583	1,918	287	3,426	3,003	62	378	297	537	0	185,863
Suffolk	8,198	2,196	7,369	53,300	3,887	4,097	118	3,117	2,468	69	460	273	551	14	86,118
Virginia Beach	54,471	94,066	9,844	5,882	839,267	2,710	22,566	6,582	7,391	206	1,493	910	1,550	0	1,046,938
Isle of Wight	1,520	988	1,222	3,348	1,610	72,678	52	4,636	3,731	85	531	339	681	42	91,465
Va Bch Waterfront	360	666	171	92	13,754	46	6,486	100	163	3	33	14	29	0	21,917
Newport News	2,438	3,234	2,042	2,448	3,874	4,375	122	487,206	93,645	1,963	10,480	6,141	34,322	1,063	653,353
Hampton	1,476	2,761	1,192	1,264	3,043	2,158	114	62,755	254,500	1,578	2,099	1,308	9,422	423	344,091
Poquoson	330	507	202	308	655	442	15	11,075	13,366	16,225	710	533	6,840	147	51,354
Williamsburg	32	33	18	26	69	34	3	783	229	9	17,878	3,660	3,311	26	26,111
James City	610	920	461	529	1,213	719	23	11,795	4,514	210	53,767	115,422	18,629	559	209,370
York	527	808	393	519	1,037	746	35	39,016	18,621	1,903	15,010	6,647	62,896	388	148,545
Gloucester	81	139	68	73	153	94	2	1,185	612	32	409	254	517	34,977	38,595
Total	427,319	501,317	212,769	97,153	1,065,686	96,679	32,397	646,322	417,489	22,724	105,533	137,409	142,082	37,639	3,942,519

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	109,825	19,658	19,051	5,611	34,042	1,305	345	2,268	1,329	123	195	566	560	129	195,007
Norfolk	19,422	197,656	8,541	1,534	57,369	762	604	1,840	2,196	81	333	885	625	159	292,005
Portsmouth	19,153	8,680	53,391	4,222	5,484	841	94	1,084	744	30	143	357	260	61	94,544
Suffolk	5,823	1,618	4,294	22,100	2,087	2,161	43	1,307	877	39	102	374	258	71	41,155
Virginia Beach	33,634	57,209	5,363	1,965	362,730	1,498	8,347	3,686	2,189	215	231	798	964	226	479,056
Isle of Wight	1,412	845	900	2,243	1,663	32,127	60	2,609	1,754	67	106	453	396	98	44,733
Va Bch Waterfront	342	603	92	40	8,338	54	2,288	112	110	6	8	16	19	7	12,034
Newport News	2,479	2,043	1,183	1,364	4,071	2,562	118	175,643	37,393	1,790	2,276	5,985	16,032	610	253,550
Hampton	1,409	2,328	779	908	2,367	1,763	124	37,177	110,925	1,932	528	1,340	6,751	440	168,770
Poquoson	137	86	32	42	236	71	6	1,778	1,945	2,857	51	125	1,188	37	8,592
Williamsburg	223	376	160	110	262	110	9	2,371	560	55	14,347	11,359	4,731	99	34,772
James City	640	988	399	406	906	472	18	6,175	1,417	133	11,373	64,957	7,297	381	95,562
York	615	702	285	271	1,072	400	20	16,212	6,852	1,208	4,710	7,255	22,545	197	62,343
Gloucester	150	214	90	97	230	140	6	810	287	37	112	295	486	13,366	16,319
Total	195,265	293,006	94,559	40,912	480,855	44,266	12,080	253,071	168,578	8,573	34,515	94,766	62,115	15,880	1,798,442


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Hampton Roads Crossing
Segment 1
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
HBW Internal
to York County
+13%
- 21%
- 29%
+ 75%
+ 36%
- 17%
-21%
- 18%
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT
NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
NORFOLK
PORTSMOUTH
VIRGINIA
BEACH
SUFFOLK
CHESAPEAKE
Graphic Created by Fitzgerald & Halliday, Inc.
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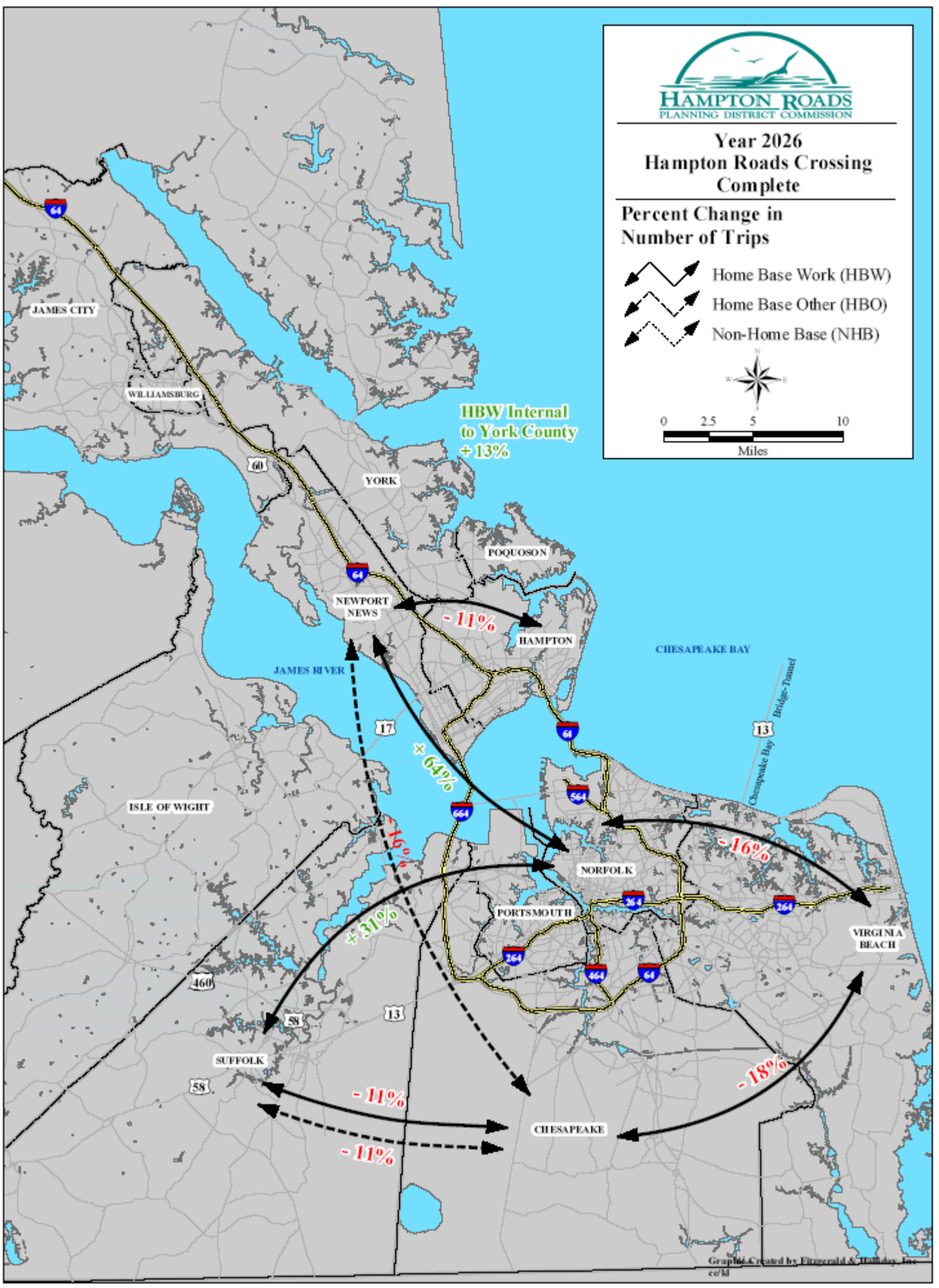
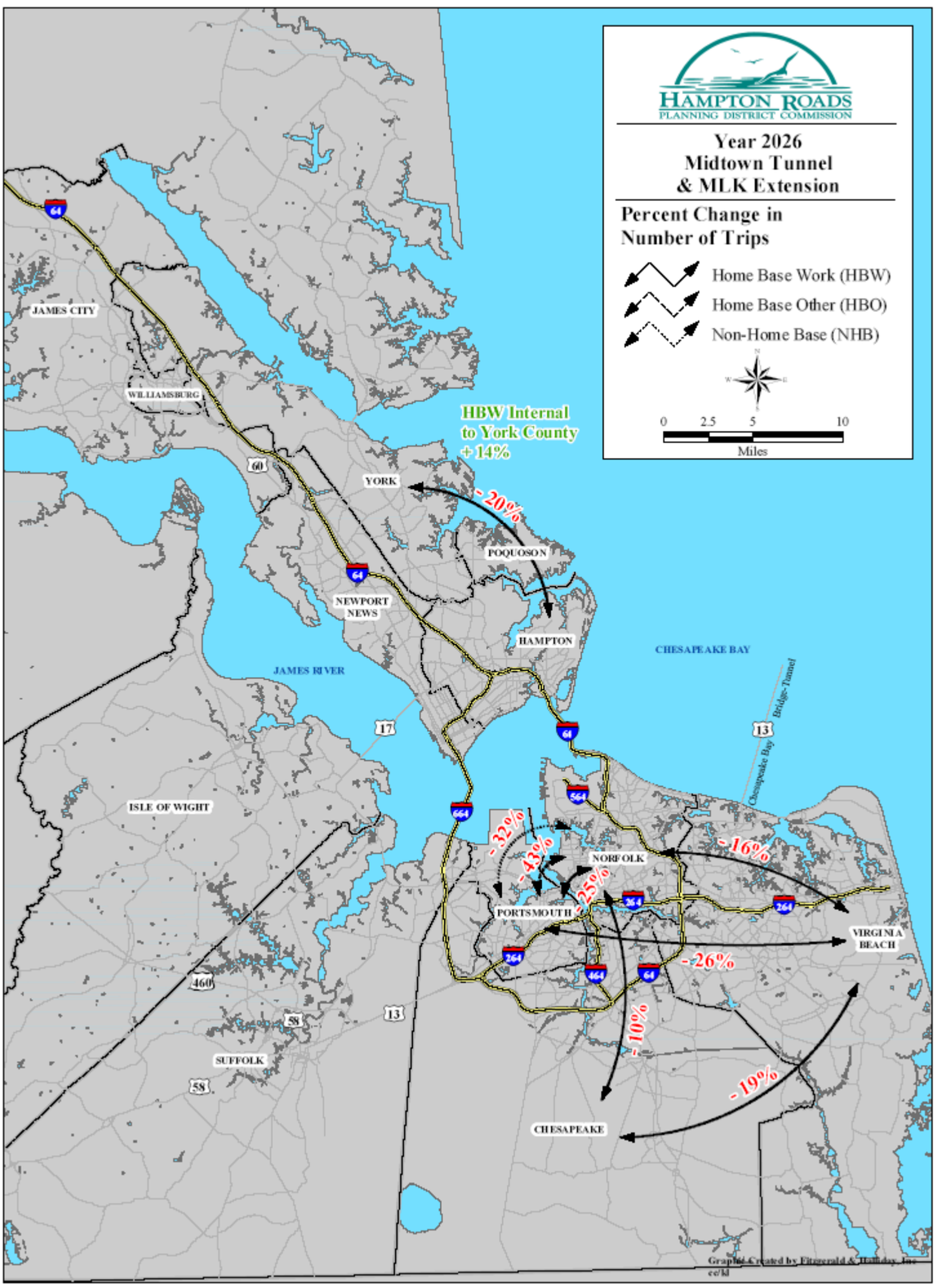
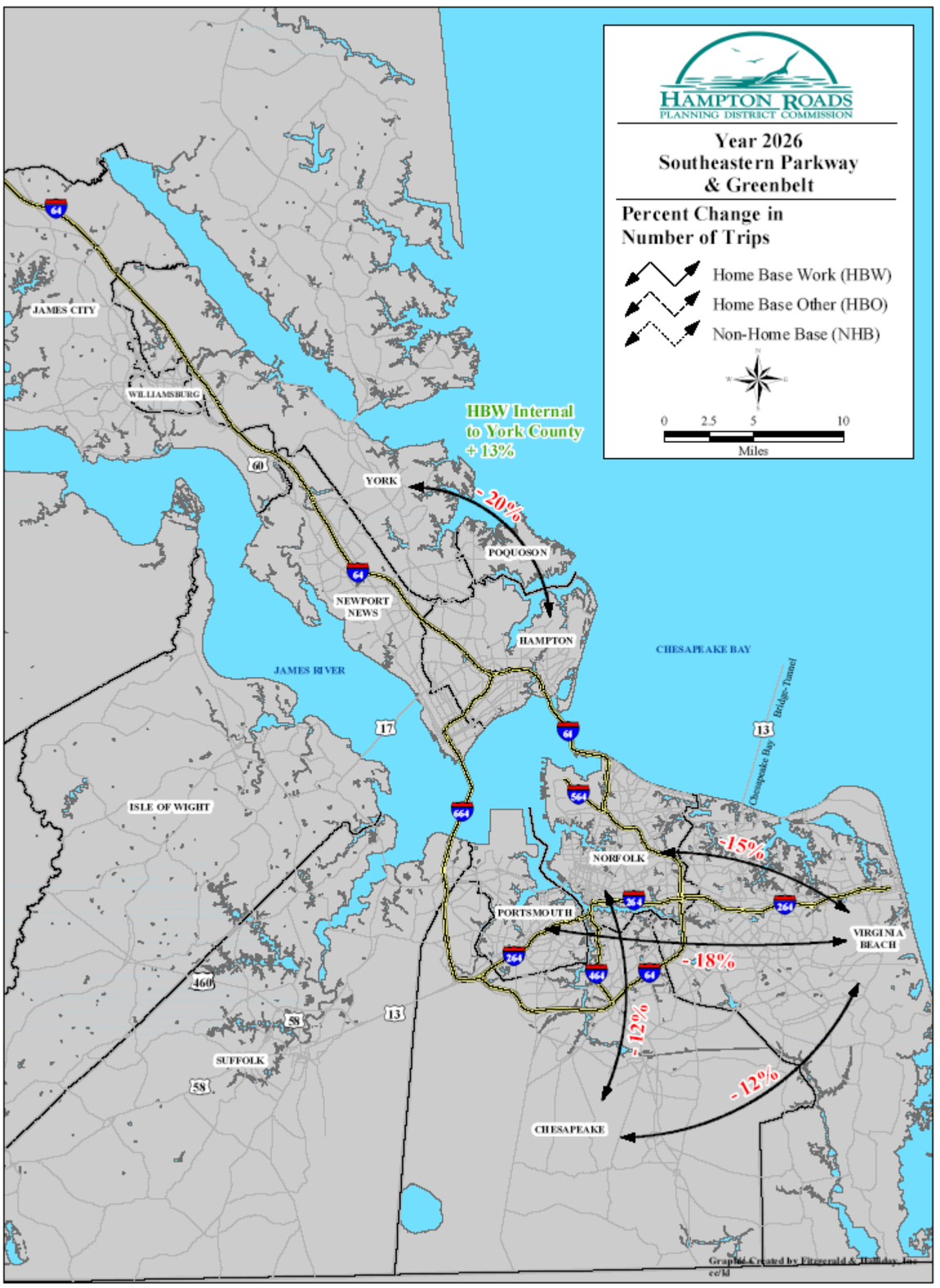
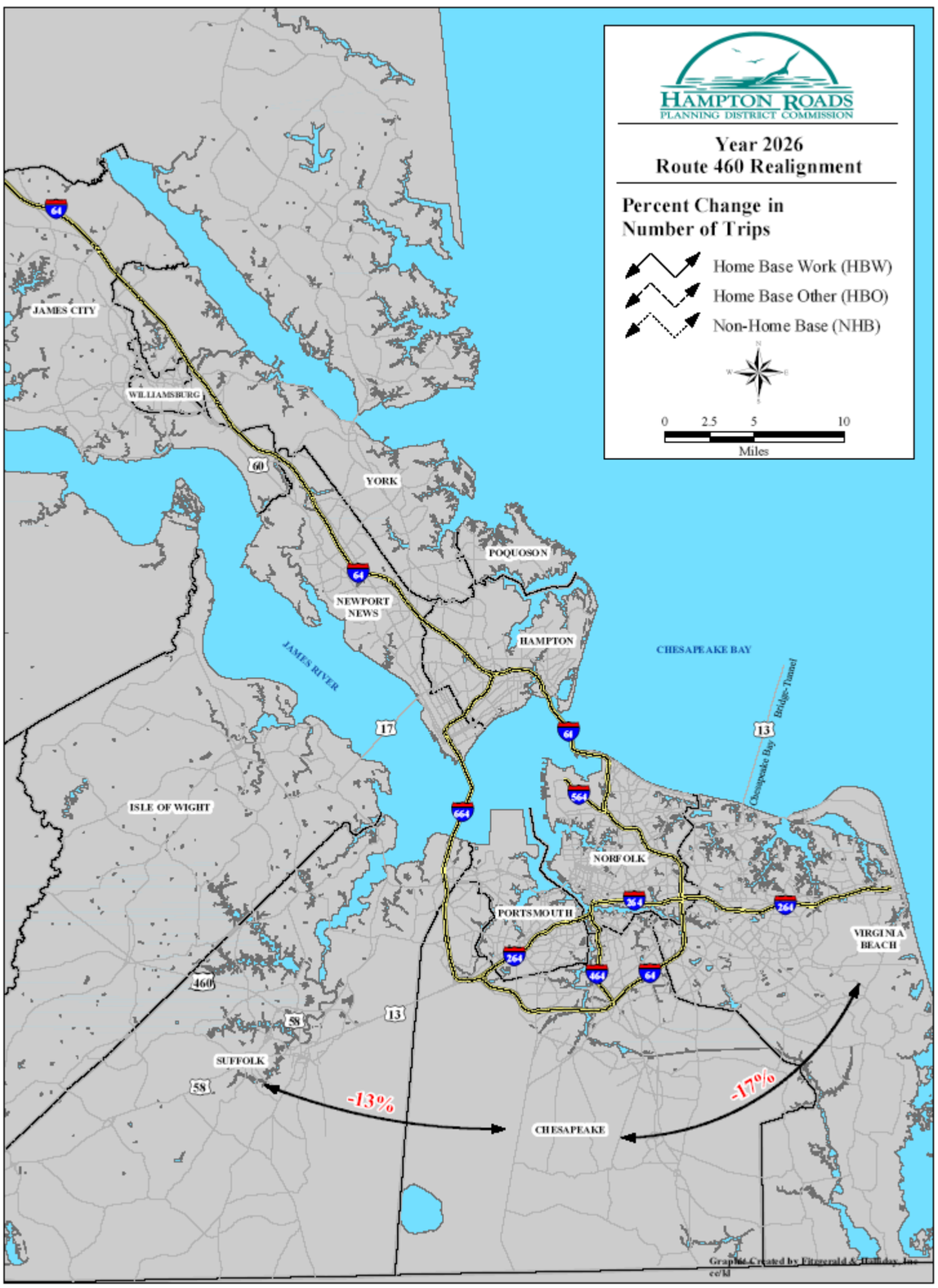
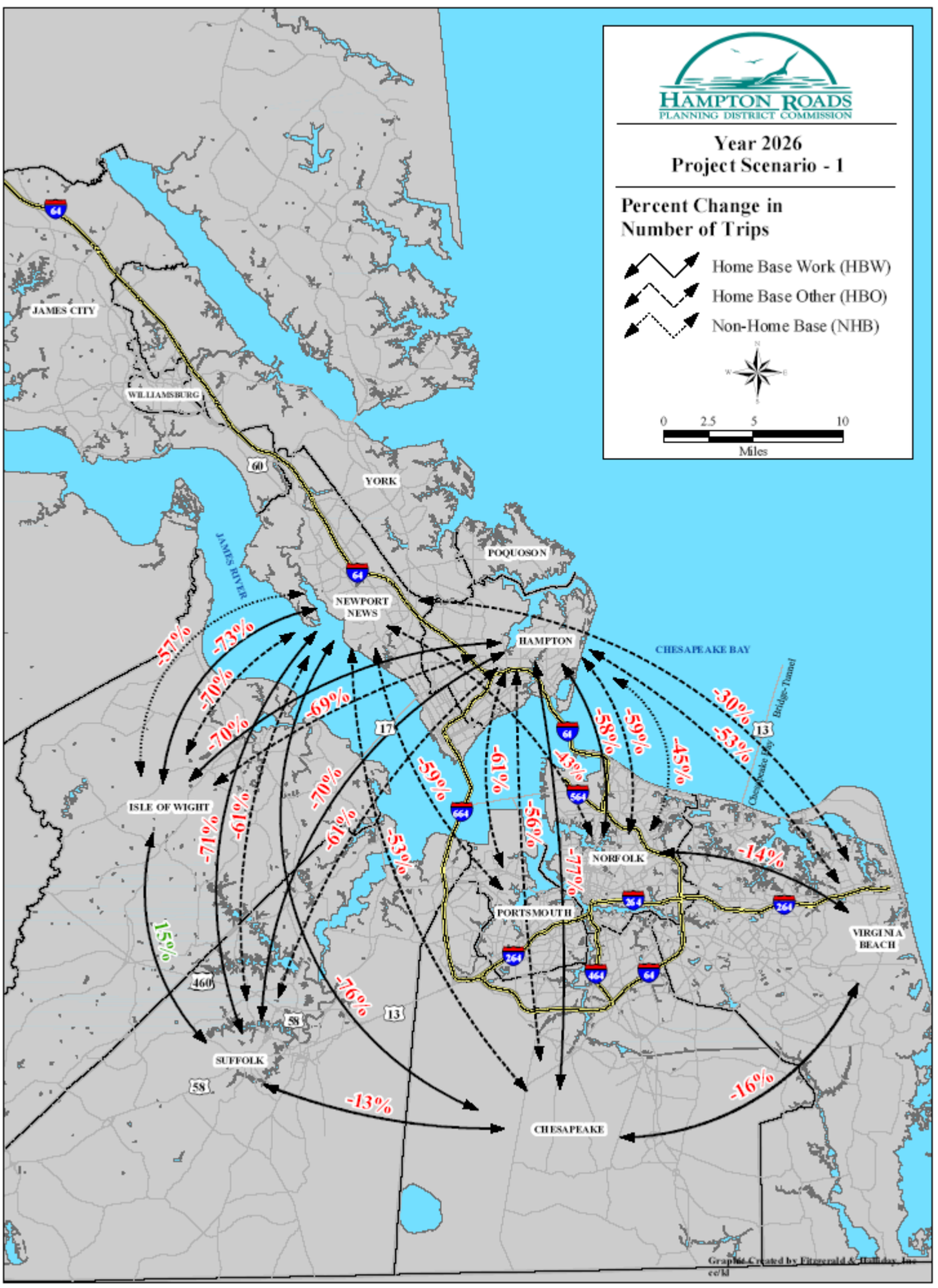
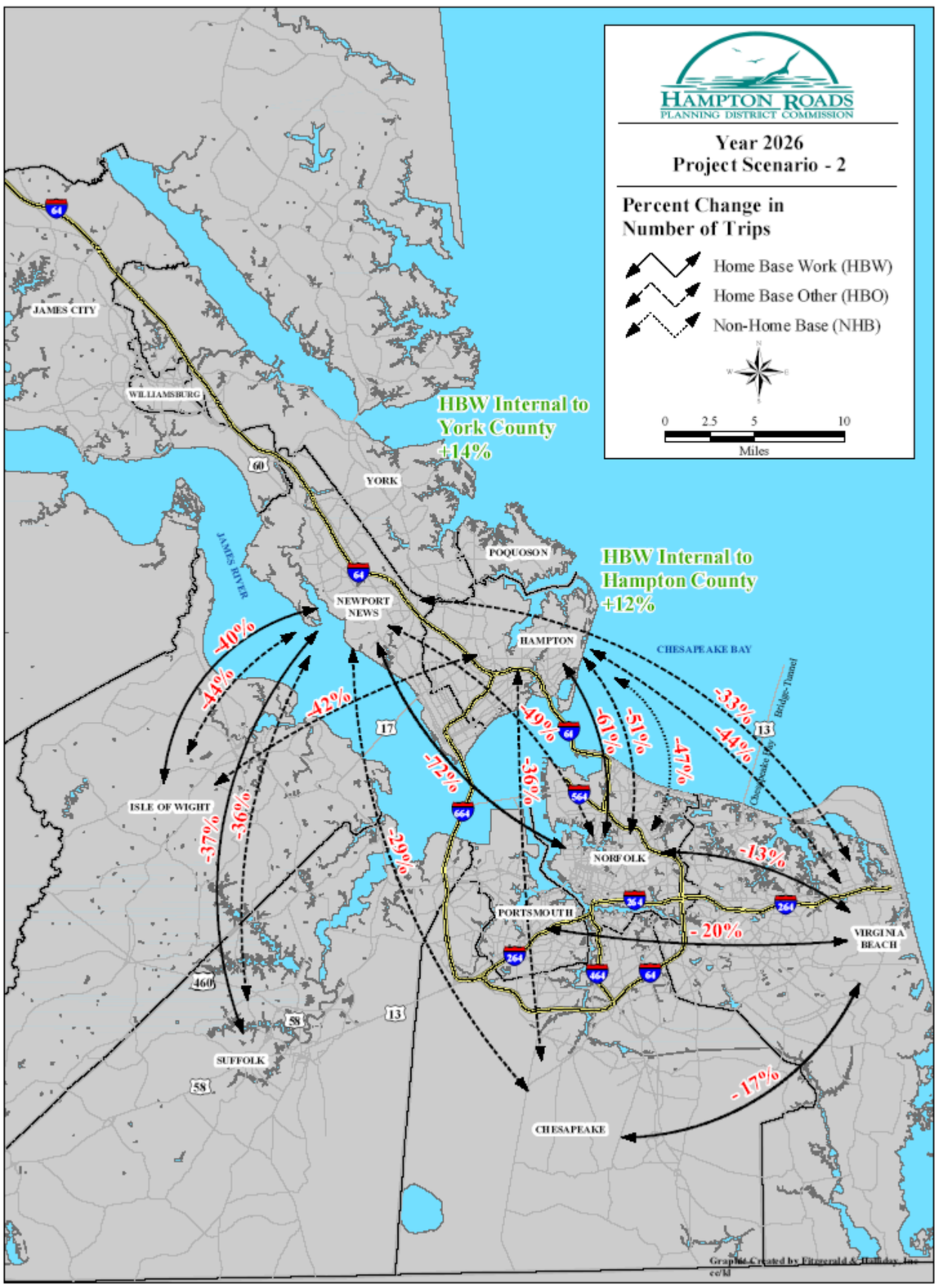

HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Hampton Roads Crossing
Complete
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
HBW Internal
to York County
+ 13%
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT
NEWS
HAMPTON
- 11%
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
+ 64%
ISLE OF WIGHT
- 16%
NORFOLK
PORTSMOUTH
VIRGINIA
BEACH
+ 31%
SUFFOLK
- 11%
- 11%
CHESAPEAKE
- 18%
Graphic Created by Fitzgerald & Halliday, Inc.
ce/kl

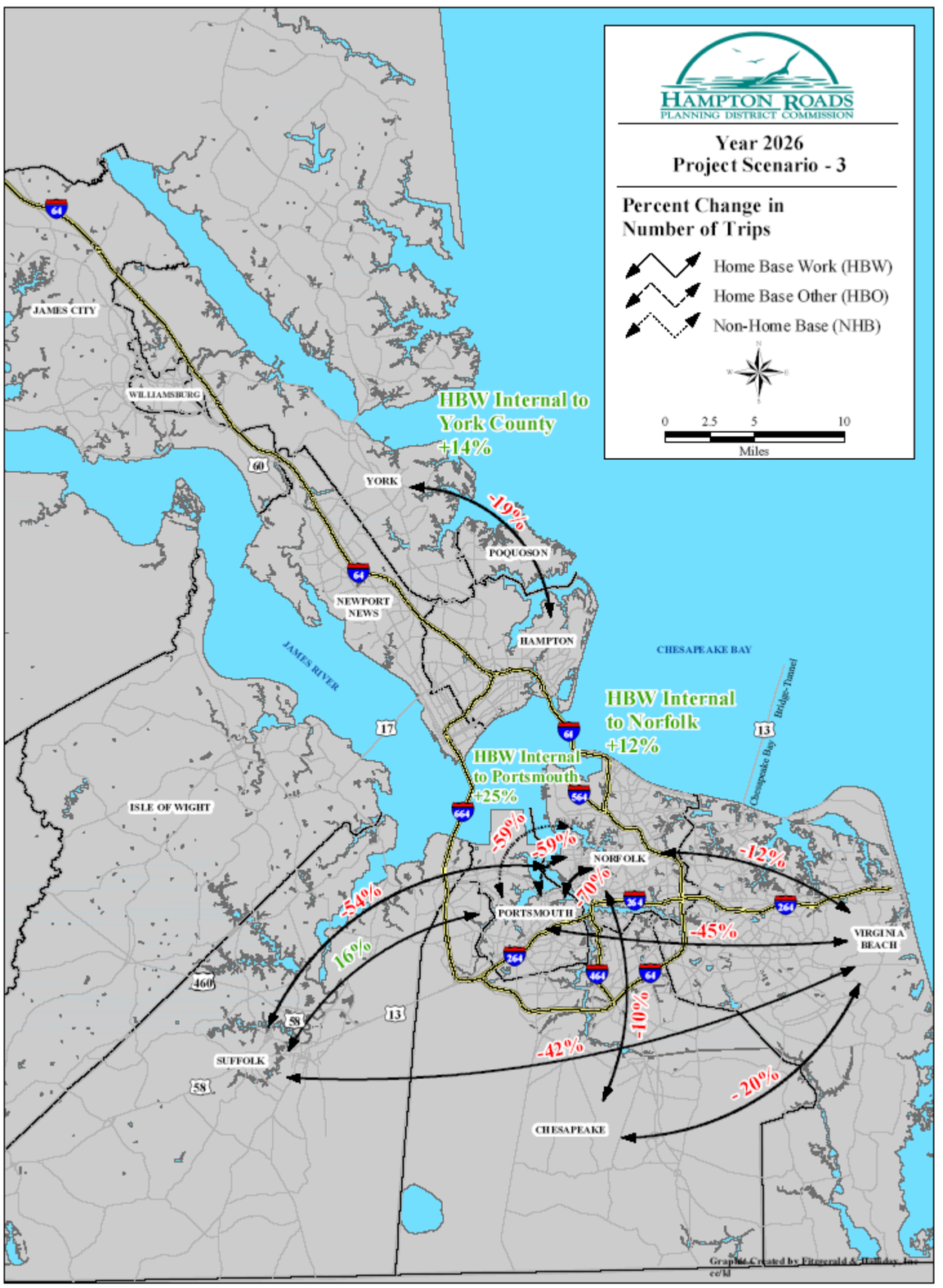

HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Midtown Tunnel
& MLK Extension
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
HBW Internal
to York County
+14%
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT
NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
NORFOLK
PORTSMOUTH
VIRGINIA
BEACH
SUFFOLK
CHESAPEAKE
-20%
-32%
-43%
-25%
-16%
-26%
-10%
-19%


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Southeastern Parkway
& Greenbelt
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
HBW Internal
to York County
+13%
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
SUFFOLK
CHESAPEAKE
-20%
-15%
-18%
-12%
-12%
Graphic Created by Fitzgerald & Halliday, Inc.


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Route 460 Realignment
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
SUFFOLK
CHESAPEAKE
-13%
-17%
Graphic Created by Fitzgerald & Halliday, Inc.
ce/kl


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario - 1
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
SUFFOLK
CHESAPEAKE
-57%
-73%
-70%
-70%
-69%
-59%
-61%
-70%
-61%
-71%
-61%
-53%
-56%
-77%
-58%
-59%
-45%
-43%
-30%
-53%
-14%
15%
-76%
-13%
-16%


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario - 2
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
HBW Internal to
York County
+14%
HBW Internal to
Hampton County
+12%
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT
NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
SUFFOLK
NORFOLK
PORTSMOUTH
VIRGINIA
BEACH
CHESAPEAKE
-40%
-44%
-42%
-37%
-36%
-29%
-72%
-49%
-36%
-61%
-51%
-47%
-33%
-44%
-13%
- 20%
- 17%
Graphic Created by Fitzgerald & Halliday, Inc.
ce/ld


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario - 3
Percent Change in
Number of Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
HBW Internal to
York County
+14%
HBW Internal
to Norfolk
+12%
HBW Internal
to Portsmouth
+25%
-19%
-59%
-59%
-70%
-12%
-54%
16%
-45%
-10%
-42%
-20%
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT
NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
NORFOLK
PORTSMOUTH
VIRGINIA
BEACH
SUFFOLK
CHESAPEAKE
Graphic Created by Fitzgerald & Halliday, Inc
ce/kl

Toll Feasibility Study
Addendum- Appendix B

Reduced Tolls – Travel Patterns

Note: Definition of Project Scenarios:

Features	Project Scenario #1	Project Scenario #2	Project Scenario #3
Projects	• HRX	• Improved HRBT (1)	• Midtown & MLK
Existing/Unimproved, Tolled Roadways	• MMMBT • JRB • HRBT	• MMMBT • JRB • HRBT	• Downtown Tunnel

(3) Hampton Roads Crossing Study, Alternative #1
MMMBT – Monitor Merrimac Bridge Tunnel
JRB – James River Bridge
HRBT – Hampton Roads Bridge Tunnel

Table B-1 Daily Travel Pattern – No Project

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	148,431	44,148	27,401	13,387	33,083	1,575	586	1,894	1,078	12	50	71	105	0	271,820
Norfolk	16,135	158,210	7,365	1,226	37,042	204	599	840	1,339	13	64	81	106	0	223,223
Portsmouth	21,277	16,915	39,175	7,715	3,947	1,057	90	1,304	717	8	45	54	73	0	92,379
Suffolk	15,610	6,047	8,353	57,799	2,371	5,664	55	3,203	1,611	21	92	122	181	3	101,133
Virginia Beach	63,196	123,746	8,727	3,090	354,912	432	16,144	818	944	12	27	35	82	0	572,164
Isle of Wight	1,417	759	807	4,116	259	26,439	7	2,939	1,427	20	77	99	163	5	38,534
Va Bch Waterfront	1,153	3,171	218	71	17,554	12	6,597	23	27	1	0	0	2	0	28,828
Newport News	1,789	3,196	997	2,116	548	3,742	12	144,128	38,092	1,029	9,549	13,696	19,260	1,813	239,968
Hampton	1,661	6,872	895	1,497	1,330	2,453	25	44,717	82,527	940	1,712	2,265	4,950	301	152,144
Poquoson	88	325	46	87	67	161	2	4,467	5,194	2,488	398	527	1,825	108	15,784
Williamsburg	2	10	2	3	1	5	0	492	100	5	6,308	3,649	1,777	42	12,396
James City	15	66	9	19	6	38	0	2,847	562	25	15,715	39,584	8,019	166	67,071
York	233	799	125	254	156	470	4	23,198	11,678	1,093	8,894	10,134	21,735	1,633	80,405
Gloucester	1	6	1	2	0	5	0	300	72	4	122	149	277	21,147	22,087
Total	271,010	364,270	94,122	91,381	451,276	42,257	24,119	231,170	145,367	5,671	43,054	70,467	58,554	25,219	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	316,538	49,404	61,376	17,272	103,700	4,575	1,644	10,060	8,932	228	1,744	1,123	1,823	0	578,420
Norfolk	20,550	342,581	10,403	2,635	91,294	1,217	1,055	5,612	7,250	173	733	627	1,175	1	485,306
Portsmouth	30,099	10,486	123,502	8,448	9,312	1,710	311	3,761	3,293	68	421	332	592	0	192,335
Suffolk	9,182	2,813	8,188	59,072	4,991	4,281	155	4,000	3,163	88	606	364	718	16	97,636
Virginia Beach	53,935	95,090	9,525	5,194	849,748	2,191	22,855	6,771	7,582	211	1,554	951	1,602	0	1,057,209
Isle of Wight	1,862	1,293	1,490	3,850	2,095	80,369	72	5,723	4,581	111	707	441	868	51	103,514
Va Bch Waterfront	351	670	165	81	13,896	37	6,557	102	166	3	34	14	29	0	22,106
Newport News	2,322	3,215	1,937	2,145	3,858	3,728	122	492,108	94,534	1,971	10,704	6,288	34,664	1,102	658,700
Hampton	1,411	2,753	1,133	1,113	3,039	1,846	114	63,409	257,071	1,591	2,154	1,347	9,545	439	346,965
Poquoson	318	509	193	273	657	383	15	11,292	13,590	16,455	734	553	6,970	154	52,096
Williamsburg	30	32	17	22	68	28	3	776	226	9	17,917	3,677	3,317	27	26,147
James City	571	895	428	452	1,182	583	22	11,704	4,453	207	53,900	116,099	18,675	567	209,739
York	502	802	372	453	1,031	622	35	39,461	18,788	1,916	15,103	6,711	63,522	402	149,718
Gloucester	75	133	63	62	148	74	2	1,161	598	31	406	253	508	35,115	38,629
Total	437,746	510,675	218,793	101,073	1,085,020	101,643	32,961	655,941	424,228	23,062	106,715	138,781	144,009	37,873	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	110,696	19,739	19,205	5,672	34,164	1,333	346	2,271	1,331	124	194	566	561	131	196,333
Norfolk	19,558	198,192	8,615	1,573	57,519	786	605	1,842	2,198	82	333	884	626	161	292,973
Portsmouth	19,272	8,746	53,711	4,268	5,522	857	96	1,083	743	30	143	356	260	61	95,148
Suffolk	5,849	1,640	4,324	22,866	2,121	2,241	43	1,333	896	40	103	380	263	74	42,176
Virginia Beach	33,865	57,352	5,412	2,034	363,655	1,536	8,366	3,690	2,193	216	231	798	965	229	480,542
Isle of Wight	1,426	852	911	2,323	1,673	33,405	61	2,657	1,755	67	102	446	389	97	46,164
Va Bch Waterfront	345	604	92	41	8,359	56	2,294	112	110	6	8	16	19	7	12,070
Newport News	2,508	2,057	1,198	1,420	4,093	2,642	118	176,229	37,538	1,799	2,278	5,999	16,087	620	254,585
Hampton	1,425	2,339	788	945	2,379	1,794	125	37,304	111,291	1,941	528	1,342	6,772	446	169,419
Poquoson	139	87	32	44	237	79	6	1,783	1,951	2,871	51	126	1,191	38	8,633
Williamsburg	226	379	162	114	264	109	9	2,381	563	55	14,372	11,387	4,744	101	34,866
James City	649	995	404	422	913	477	18	6,206	1,425	134	11,398	65,176	7,324	388	95,929
York	622	707	288	283	1,078	401	21	16,267	6,878	1,214	4,719	7,277	22,637	200	62,593
Gloucester	151	214	90	100	230	141	6	808	286	37	112	294	485	13,477	16,429
Total	196,730	293,902	95,233	42,107	482,208	45,858	12,113	253,964	169,159	8,616	34,571	95,047	62,323	16,029	1,807,860

Table B-2 Daily Travel Pattern – Project Scenario #1

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	159,499	43,763	27,403	12,684	24,710	1,327	376	1,294	691	6	17	14	36	0	271,820
Norfolk	15,493	164,344	7,881	1,906	29,790	346	409	1,758	1,149	8	38	35	65	0	223,223
Portsmouth	20,442	19,191	39,937	7,454	2,964	917	55	890	461	4	15	17	31	0	92,379
Suffolk	13,329	9,537	8,167	59,048	1,602	6,196	29	1,999	1,046	9	42	52	78	0	101,133
Virginia Beach	58,248	109,236	8,300	2,947	374,159	380	16,943	1,209	710	5	0	1	24	0	572,164
Isle of Wight	1,122	1,175	739	4,372	175	28,495	3	1,500	812	8	32	40	61	0	38,534
Va Bch Waterfront	951	2,753	187	58	18,405	8	6,410	34	21	0	0	0	0	0	28,828
Newport News	1,123	6,997	737	1,342	618	2,156	9	150,139	33,446	652	9,382	13,648	18,021	1,698	239,968
Hampton	1,137	7,313	767	1,191	824	1,764	14	42,803	89,944	667	949	1,269	3,345	156	152,144
Poquoson	63	342	37	70	43	118	0	4,012	5,287	3,355	268	367	1,716	104	15,784
Williamsburg	1	6	0	1	0	2	0	366	43	2	6,629	3,475	1,843	30	12,396
James City	3	27	1	5	0	13	0	2,387	269	10	15,603	40,576	8,027	151	67,071
York	119	746	83	150	81	242	1	21,425	11,212	936	9,367	9,792	24,463	1,790	80,405
Gloucester	0	1	0	0	0	1	0	282	51	3	148	173	295	21,131	22,087
Total	271,529	365,431	94,241	91,228	453,371	41,965	24,251	230,099	145,143	5,666	42,489	69,458	58,007	25,059	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	320,951	50,436	62,101	16,216	105,788	4,184	1,678	7,352	6,229	158	1,237	697	1,393	0	578,420
Norfolk	20,534	343,796	10,456	2,659	91,858	1,287	1,062	6,005	5,109	127	834	630	950	0	485,306
Portsmouth	30,246	10,939	124,784	8,465	9,540	1,708	319	2,706	2,349	48	412	318	502	0	192,335
Suffolk	8,537	2,982	8,283	62,411	4,805	4,567	150	2,543	2,247	55	359	249	448	0	97,636
Virginia Beach	53,602	95,322	9,395	4,796	852,907	1,881	22,944	6,875	5,974	148	1,296	701	1,367	0	1,057,209
Isle of Wight	1,835	1,468	1,638	4,295	2,098	85,083	71	3,086	2,601	60	436	291	550	1	103,514
Va Bch Waterfront	342	671	163	73	13,962	29	6,590	140	78	4	20	5	29	0	22,106
Newport News	1,542	3,049	1,166	1,122	3,505	1,446	137	496,120	95,760	1,964	10,755	6,266	34,826	1,040	658,700
Hampton	848	1,653	684	620	1,970	765	51	62,828	262,590	1,580	2,135	1,319	9,510	412	346,965
Poquoson	165	386	159	139	412	156	21	11,432	14,102	16,617	740	551	7,072	146	52,096
Williamsburg	19	31	15	13	56	17	2	781	235	9	17,958	3,666	3,320	25	26,147
James City	337	803	346	272	803	307	10	11,901	4,650	211	54,377	116,361	18,818	544	209,739
York	331	590	273	239	814	309	34	39,731	19,282	1,922	15,167	6,703	63,941	382	149,718
Gloucester	38	119	48	34	79	44	0	1,232	651	33	430	265	537	35,119	38,629
Total	439,329	512,247	219,511	101,353	1,088,597	101,782	33,069	652,730	421,856	22,935	106,155	138,024	143,263	37,669	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	111,257	19,980	19,177	5,390	34,196	1,304	346	1,969	1,336	106	149	477	518	127	196,333
Norfolk	19,861	196,522	9,281	1,948	57,437	934	604	2,532	1,778	80	355	867	620	155	292,973
Portsmouth	19,233	9,378	53,534	4,225	5,564	864	96	1,006	490	48	111	276	267	56	95,148
Suffolk	5,532	2,015	4,282	23,466	2,028	2,368	37	1,027	653	54	107	303	247	58	42,176
Virginia Beach	33,944	57,172	5,457	1,945	363,819	1,534	8,379	3,612	2,336	227	218	754	917	227	480,542
Isle of Wight	1,397	1,009	924	2,469	1,672	35,043	58	1,550	1,057	61	111	429	308	76	46,164
Va Bch Waterfront	345	602	93	35	8,370	54	2,299	97	123	3	7	17	19	7	12,070
Newport News	2,199	2,854	1,105	1,086	3,995	1,538	107	177,572	37,299	1,788	2,282	6,028	16,118	614	254,585
Hampton	1,426	1,929	526	672	2,525	1,059	131	37,132	112,958	1,948	531	1,348	6,792	441	169,419
Poquoson	126	82	44	54	246	61	4	1,784	1,964	2,864	51	125	1,190	37	8,633
Williamsburg	175	415	128	116	256	117	9	2,390	569	55	14,380	11,407	4,752	99	34,866
James City	543	1,004	315	336	882	453	18	6,246	1,443	135	11,424	65,391	7,357	384	95,929
York	573	697	293	263	1,029	312	20	16,306	6,928	1,213	4,726	7,304	22,731	198	62,593
Gloucester	126	211	75	79	218	114	5	826	293	38	114	299	495	13,535	16,429
Total	196,736	293,870	95,232	42,086	482,237	45,754	12,114	254,049	169,228	8,618	34,566	95,026	62,330	16,014	1,807,860

Table B-3 Daily Travel Pattern – Project Scenario #2

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	158,757	43,814	27,359	12,866	25,192	1,341	389	1,251	764	7	20	16	43	0	271,820
Norfolk	14,193	169,896	6,549	1,120	29,268	169	408	551	972	7	20	23	47	0	223,223
Portsmouth	21,142	17,136	40,803	7,899	2,951	928	58	874	510	5	17	19	36	0	92,379
Suffolk	15,071	6,390	9,013	59,213	1,747	5,978	36	2,238	1,223	11	51	65	97	0	101,133
Virginia Beach	56,645	114,290	7,614	2,638	372,705	343	16,862	445	602	4	0	0	15	0	572,164
Isle of Wight	1,253	730	783	4,308	183	28,241	4	1,859	996	10	38	49	79	1	38,534
Va Bch Waterfront	924	2,926	171	55	18,335	8	6,381	10	17	0	0	0	0	0	28,828
Newport News	1,233	1,985	765	1,581	264	2,674	3	152,397	34,710	660	9,674	13,927	18,345	1,750	239,968
Hampton	1,268	6,191	820	1,304	877	2,037	15	43,569	89,518	666	998	1,326	3,396	158	152,144
Poquoson	71	242	39	77	43	128	0	4,014	5,294	3,381	275	376	1,736	108	15,784
Williamsburg	1	1	0	1	0	2	0	364	41	2	6,629	3,488	1,838	30	12,396
James City	3	6	1	6	0	15	0	2,391	269	10	15,551	40,664	8,002	153	67,071
York	138	440	86	164	70	301	0	21,543	11,142	934	9,400	9,846	24,502	1,838	80,405
Gloucester	0	0	0	0	0	2	0	273	50	3	146	170	289	21,153	22,087
Total	270,699	364,049	94,002	91,233	451,636	42,168	24,156	231,779	146,107	5,698	42,819	69,970	58,425	25,192	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	319,265	50,123	62,111	17,513	105,229	4,620	1,674	7,632	6,635	159	1,325	711	1,424	0	578,420
Norfolk	20,623	346,166	10,403	2,638	92,289	1,198	1,066	3,648	4,926	127	826	554	842	0	485,306
Portsmouth	30,442	10,735	124,901	8,557	9,547	1,733	319	2,645	2,176	52	457	314	458	0	192,335
Suffolk	9,426	2,928	8,399	60,557	5,197	4,477	161	2,796	2,440	62	392	278	521	0	97,636
Virginia Beach	53,899	95,602	9,460	5,170	854,252	2,170	22,970	5,268	5,874	147	871	375	1,151	0	1,057,209
Isle of Wight	1,999	1,390	1,596	4,119	2,266	83,820	78	3,620	3,049	84	462	333	687	10	103,514
Va Bch Waterfront	350	674	164	81	13,979	37	6,594	119	79	4	1	1	24	0	22,106
Newport News	1,555	1,812	1,126	1,239	2,738	1,763	117	497,715	95,748	1,976	10,757	6,251	34,878	1,025	658,700
Hampton	933	1,637	650	691	1,990	912	51	63,265	261,988	1,577	2,094	1,314	9,460	402	346,965
Poquoson	170	350	134	166	412	248	20	11,488	14,065	16,564	739	549	7,048	143	52,096
Williamsburg	19	32	15	15	41	18	0	784	234	9	17,972	3,664	3,320	25	26,147
James City	315	630	337	328	399	370	3	11,998	4,641	212	54,543	116,558	18,868	537	209,739
York	329	497	244	288	721	408	30	39,901	19,192	1,919	15,179	6,699	63,935	375	149,718
Gloucester	38	87	47	44	36	49	0	1,261	653	33	438	269	547	35,127	38,629
Total	439,362	512,661	219,587	101,406	1,089,097	101,821	33,083	652,141	421,701	22,925	106,054	137,872	143,162	37,646	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	110,927	19,775	19,306	5,747	34,194	1,371	348	1,979	1,311	108	160	470	511	126	196,333
Norfolk	19,597	198,954	8,639	1,588	57,600	807	608	1,986	1,541	86	195	624	617	130	292,973
Portsmouth	19,379	8,768	53,943	4,324	5,536	884	96	979	493	42	107	276	264	57	95,148
Suffolk	5,929	1,660	4,383	23,146	2,142	2,324	44	1,095	684	43	111	316	239	62	42,176
Virginia Beach	33,894	57,451	5,422	2,050	364,048	1,562	8,404	3,320	2,365	215	190	632	765	225	480,542
Isle of Wight	1,481	881	949	2,429	1,717	34,607	63	1,846	1,200	70	110	423	307	80	46,164
Va Bch Waterfront	346	606	93	42	8,394	57	2,306	59	121	3	4	17	16	7	12,070
Newport News	2,184	2,215	1,088	1,175	3,731	1,865	65	177,869	37,485	1,804	2,283	6,037	16,169	613	254,585
Hampton	1,420	1,675	534	719	2,612	1,226	131	37,221	112,885	1,943	520	1,329	6,767	437	169,419
Poquoson	116	97	45	47	228	74	3	1,789	1,966	2,863	51	126	1,191	37	8,633
Williamsburg	187	228	124	125	225	118	4	2,407	561	55	14,473	11,475	4,785	100	34,866
James City	548	733	318	355	742	455	19	6,292	1,423	135	11,483	65,640	7,400	385	95,929
York	571	703	295	260	857	317	17	16,369	6,893	1,213	4,756	7,344	22,798	198	62,593
Gloucester	133	173	75	84	201	124	5	828	302	38	114	301	498	13,553	16,429
Total	196,712	293,919	95,214	42,089	482,227	45,794	12,114	254,040	169,229	8,618	34,557	95,009	62,326	16,010	1,807,860

Table B-4 Daily Travel Pattern – Project Scenario #3

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	158,849	43,608	26,618	12,639	25,578	1,287	394	1,680	1,049	9	26	26	56	0	271,820
Norfolk	13,947	172,174	4,363	833	29,526	128	409	635	1,094	8	24	27	55	0	223,223
Portsmouth	21,231	12,907	44,376	8,120	2,630	933	49	1,255	768	6	27	28	49	0	92,379
Suffolk	14,994	5,055	9,445	58,951	1,712	5,669	35	3,201	1,766	16	65	91	134	0	101,133
Virginia Beach	56,235	116,678	5,983	2,429	372,387	309	16,883	544	688	6	0	1	21	0	572,164
Isle of Wight	1,200	548	789	4,162	171	27,433	3	2,607	1,389	13	46	65	106	2	38,534
Va Bch Waterfront	915	2,981	130	50	18,344	7	6,367	14	19	0	0	0	0	0	28,828
Newport News	1,566	2,542	1,054	2,072	341	3,298	5	150,632	34,370	656	9,542	13,865	18,265	1,761	239,968
Hampton	1,691	6,997	1,112	1,753	1,014	2,613	16	42,562	88,132	668	916	1,231	3,281	158	152,144
Poquoson	96	282	56	106	51	180	0	3,966	5,204	3,366	270	368	1,731	108	15,784
Williamsburg	1	2	0	1	0	2	0	352	40	2	6,641	3,481	1,844	30	12,396
James City	4	10	2	8	0	17	0	2,286	255	10	15,627	40,666	8,031	154	67,071
York	169	559	111	215	86	368	1	21,367	11,070	933	9,399	9,814	24,468	1,844	80,405
Gloucester	0	0	0	1	0	2	0	274	49	3	147	171	290	21,149	22,087
Total	270,897	364,344	94,039	91,340	451,840	42,248	24,164	231,373	145,893	5,695	42,731	69,835	58,330	25,207	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	316,515	48,922	61,832	17,299	103,696	4,586	1,646	10,064	8,938	228	1,746	1,124	1,825	0	578,420
Norfolk	20,230	348,747	4,320	2,306	91,934	984	1,064	5,678	7,308	175	741	633	1,186	1	485,306
Portsmouth	30,372	4,748	128,938	8,575	9,003	1,744	315	3,836	3,358	70	432	339	605	0	192,335
Suffolk	9,199	2,531	8,318	59,172	4,996	4,296	155	4,007	3,167	88	607	364	719	16	97,636
Virginia Beach	53,877	95,724	9,248	5,198	849,459	2,193	22,845	6,769	7,579	211	1,554	952	1,602	0	1,057,209
Isle of Wight	1,867	1,068	1,528	3,869	2,101	80,502	72	5,734	4,589	111	709	442	870	51	103,514
Va Bch Waterfront	351	675	166	82	13,894	37	6,552	102	166	3	34	14	29	0	22,106
Newport News	2,322	3,246	1,983	2,147	3,856	3,735	122	492,047	94,509	1,971	10,705	6,290	34,662	1,103	658,700
Hampton	1,411	2,778	1,156	1,114	3,039	1,850	114	63,402	257,022	1,591	2,155	1,348	9,547	440	346,965
Poquoson	318	513	198	274	657	383	15	11,290	13,584	16,454	734	553	6,969	154	52,096
Williamsburg	30	33	17	22	68	28	3	775	226	9	17,916	3,678	3,317	27	26,147
James City	570	904	439	452	1,181	584	22	11,698	4,449	207	53,892	116,100	18,673	568	209,739
York	502	809	381	453	1,030	623	35	39,456	18,781	1,916	15,102	6,711	63,517	402	149,718
Gloucester	75	135	64	62	148	74	2	1,160	597	31	406	253	507	35,116	38,629
Total	437,639	510,831	218,588	101,024	1,085,061	101,618	32,962	656,019	424,273	23,065	106,732	138,803	144,028	37,878	4,018,520

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	110,773	19,407	19,386	5,714	34,170	1,339	346	2,279	1,337	124	195	568	563	131	196,333
Norfolk	19,194	201,893	5,082	1,296	57,929	809	610	1,842	2,214	82	335	892	632	162	292,973
Portsmouth	19,511	5,199	57,090	4,382	5,240	884	86	1,116	763	32	147	366	268	64	95,148
Suffolk	5,892	1,361	4,440	22,958	2,128	2,251	43	1,339	900	41	103	382	264	74	42,176
Virginia Beach	33,813	57,817	5,082	2,034	363,567	1,534	8,371	3,691	2,194	216	231	798	966	230	480,542
Isle of Wight	1,429	877	938	2,327	1,670	33,343	61	2,661	1,757	67	102	446	389	97	46,164
Va Bch Waterfront	344	610	83	41	8,362	56	2,296	112	110	6	8	16	19	7	12,070
Newport News	2,507	2,049	1,229	1,420	4,090	2,642	118	176,214	37,534	1,799	2,278	6,000	16,085	620	254,585
Hampton	1,426	2,357	806	945	2,377	1,793	125	37,297	111,264	1,941	528	1,342	6,771	447	169,419
Poquoson	139	87	34	44	236	79	6	1,782	1,950	2,870	51	126	1,191	38	8,633
Williamsburg	226	381	167	114	264	109	9	2,380	563	55	14,370	11,385	4,743	101	34,866
James City	649	1,003	413	422	912	476	18	6,203	1,424	134	11,396	65,169	7,322	388	95,929
York	622	713	297	283	1,077	401	21	16,264	6,876	1,214	4,719	7,276	22,631	200	62,593
Gloucester	150	216	93	100	229	141	6	807	286	37	112	294	485	13,474	16,429
Total	196,674	293,972	95,139	42,079	482,253	45,856	12,114	253,986	169,173	8,616	34,576	95,060	62,330	16,031	1,807,860

Table B-5 Daily Travel Pattern – Southeastern Parkway and Greenbelt

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	154,737	44,795	27,307	12,525	28,038	1,248	471	1,602	993	8	25	22	50	0	271,820
Norfolk	13,913	170,433	6,124	1,021	29,392	152	403	613	1,076	8	17	22	49	0	223,223
Portsmouth	20,828	16,989	40,859	7,721	3,103	870	58	1,150	705	6	23	24	43	0	92,379
Suffolk	14,495	6,211	8,827	58,999	1,764	5,677	34	3,123	1,711	15	62	86	127	0	101,133
Virginia Beach	61,602	112,080	7,953	2,740	369,305	349	16,892	562	658	5	0	0	17	0	572,164
Isle of Wight	1,147	676	728	4,159	178	27,583	3	2,515	1,326	13	44	61	100	1	38,534
Va Bch Waterfront	964	2,822	158	49	18,525	7	6,273	12	18	0	0	0	0	0	28,828
Newport News	1,553	2,480	990	2,115	330	3,258	4	151,562	33,852	659	9,443	13,805	18,230	1,687	239,968
Hampton	1,674	7,089	1,067	1,778	1,018	2,559	16	42,149	88,848	645	844	1,142	3,177	138	152,144
Poquoson	94	291	52	101	52	160	0	3,930	5,270	3,387	268	358	1,719	101	15,784
Williamsburg	1	1	0	1	0	2	0	325	31	1	6,716	3,450	1,840	28	12,396
James City	3	5	1	7	0	15	0	2,156	211	8	15,658	40,853	8,011	144	67,071
York	169	562	106	219	86	371	1	21,378	11,199	939	9,367	9,627	24,613	1,767	80,405
Gloucester	0	0	0	1	0	3	0	271	50	3	151	169	294	21,145	22,087
Total	271,180	364,435	94,172	91,436	451,791	42,254	24,156	231,349	145,948	5,698	42,619	69,618	58,271	25,011	1,917,936

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	316,939	49,203	60,961	17,286	103,834	4,559	1,661	10,038	9,030	227	1,735	1,114	1,832	0	578,420
Norfolk	20,449	342,670	10,449	2,633	91,269	1,217	1,053	5,612	7,246	173	733	627	1,174	1	485,306
Portsmouth	29,893	10,481	123,765	8,444	9,282	1,707	310	3,755	3,286	68	420	332	591	0	192,335
Suffolk	9,157	2,816	8,212	59,071	4,986	4,283	155	4,002	3,162	88	606	364	718	16	97,636
Virginia Beach	53,875	95,186	9,558	5,182	849,684	2,195	22,843	6,781	7,583	212	1,555	952	1,603	0	1,057,209
Isle of Wight	1,847	1,294	1,496	3,851	2,094	80,377	72	5,724	4,580	111	707	441	868	51	103,514
Va Bch Waterfront	351	671	166	82	13,896	37	6,555	102	166	3	34	14	29	0	22,106
Newport News	2,319	3,217	1,945	2,145	3,854	3,730	122	492,128	94,504	1,972	10,708	6,290	34,665	1,102	658,700
Hampton	1,412	2,755	1,137	1,113	3,038	1,847	114	63,433	257,037	1,591	2,155	1,348	9,545	440	346,965
Poquoson	322	509	194	273	657	383	15	11,292	13,587	16,455	734	553	6,968	154	52,096
Williamsburg	30	32	17	22	68	28	3	775	226	9	17,917	3,677	3,317	27	26,147
James City	562	895	430	452	1,181	583	22	11,702	4,451	207	53,904	116,107	18,676	567	209,739
York	504	802	374	453	1,030	622	35	39,461	18,787	1,916	15,104	6,711	63,518	402	149,718
Gloucester	74	133	63	62	148	74	2	1,161	598	31	406	253	508	35,115	38,629
Total	437,734	510,666	218,767	101,067	1,085,022	101,643	32,961	655,965	424,244	23,063	106,718	138,783	144,014	37,874	4,018,520

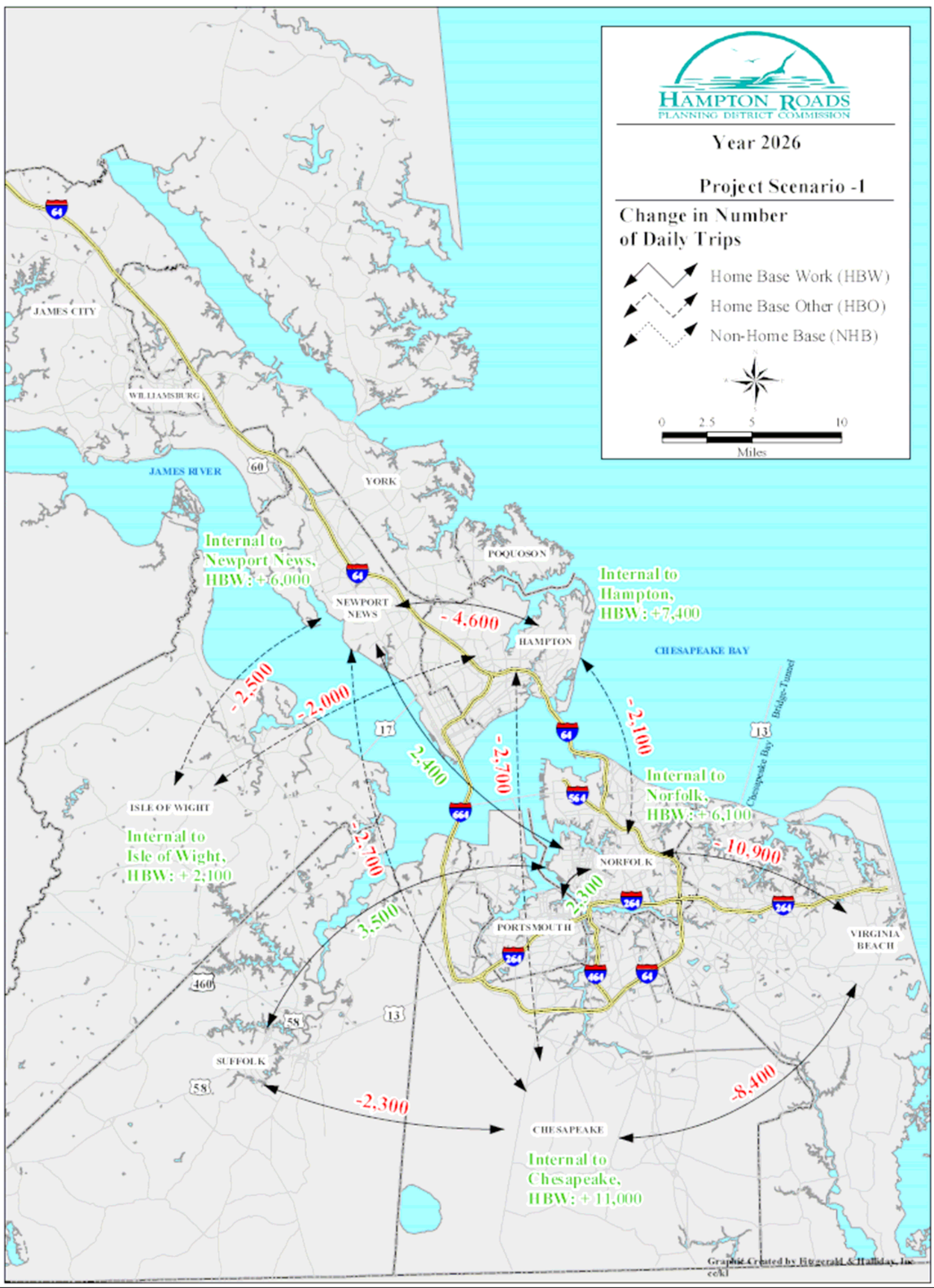
Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	110,765	19,698	19,083	5,660	34,251	1,338	346	2,265	1,341	125	194	570	566	131	196,333
Norfolk	19,515	198,219	8,628	1,573	57,520	787	605	1,843	2,199	82	333	885	626	161	292,973
Portsmouth	19,168	8,754	53,802	4,270	5,525	857	96	1,083	743	30	143	356	260	62	95,148
Suffolk	5,835	1,641	4,330	22,873	2,122	2,243	43	1,333	896	40	103	381	264	74	42,176
Virginia Beach	33,945	57,354	5,417	2,036	363,565	1,536	8,369	3,688	2,192	216	231	798	965	229	480,542
Isle of Wight	1,436	852	911	2,323	1,671	33,399	61	2,656	1,755	67	102	446	389	97	46,164
Va Bch Waterfront	345	604	93	41	8,362	56	2,292	112	110	6	8	16	19	7	12,070
Newport News	2,489	2,057	1,199	1,420	4,089	2,642	118	176,246	37,540	1,799	2,278	6,001	16,088	620	254,585
Hampton	1,437	2,339	789	945	2,377	1,794	124	37,302	111,285	1,941	528	1,342	6,769	446	169,419
Poquoson	135	87	32	44	237	79	6	1,784	1,952	2,871	51	126	1,192	38	8,633
Williamsburg	223	378	162	114	264	109	9	2,381	563	55	14,374	11,388	4,744	101	34,866
James City	655	995	405	422	913	477	18	6,206	1,425	134	11,396	65,171	7,324	388	95,929
York	627	707	289	283	1,078	401	21	16,265	6,878	1,214	4,720	7,278	22,635	200	62,593
Gloucester	151	214	90	100	230	141	6	807	286	37	112	294	485	13,477	16,429
Total	196,726	293,897	95,229	42,105	482,202	45,859	12,113	253,971	169,164	8,616	34,573	95,050	62,325	16,029	1,807,860

Table B-6 Daily Travel Pattern – Route 460 Realignment

Home-Based Work	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	159,927	43,557	27,197	11,470	25,088	1,207	378	1,717	1,076	9	30	38	62	0	271,757
Norfolk	13,944	170,456	6,173	919	29,129	148	397	706	1,196	9	40	41	64	0	223,221
Portsmouth	21,064	16,207	41,884	7,275	2,840	866	54	1,249	769	6	32	38	53	0	92,336
Suffolk	13,637	5,446	8,327	59,852	1,416	6,049	29	3,144	1,718	15	69	101	132	0	99,935
Virginia Beach	56,632	114,091	7,210	2,120	373,482	283	16,980	588	740	6	1	4	26	0	572,161
Isle of Wight	1,090	606	692	4,558	145	25,946	3	2,511	1,315	13	51	70	102	0	37,102
Va Bch Waterfront	891	2,915	153	43	18,464	7	6,318	15	21	0	0	0	0	0	28,828
Newport News	1,599	2,777	1,046	2,012	365	3,240	5	150,584	34,717	655	9,781	14,373	17,875	911	239,938
Hampton	1,728	7,411	1,088	1,659	1,061	2,454	16	42,597	87,235	644	1,161	1,528	3,468	63	152,114
Poquoson	97	308	55	92	54	153	0	3,941	5,210	3,382	309	420	1,735	25	15,781
Williamsburg	1	4	1	2	0	3	0	396	52	2	6,630	3,487	1,810	9	12,396
James City	7	21	4	11	1	23	0	2,608	334	12	15,614	40,411	7,986	40	67,071
York	178	631	115	213	97	367	1	21,427	11,424	944	9,209	9,702	25,113	978	80,401
Gloucester	0	0	0	0	0	1	0	188	37	2	87	101	199	21,471	22,087
Total	270,794	364,429	93,944	90,226	452,144	40,747	24,182	231,671	145,845	5,699	43,012	70,312	58,625	23,498	1,915,128

Home-Based Other	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	307,335	46,966	59,176	17,823	98,445	5,193	1,538	9,190	8,181	209	1,582	1,014	1,661	0	558,312
Norfolk	20,723	338,345	10,707	2,975	90,095	1,471	1,037	5,456	7,065	169	702	598	1,138	1	480,481
Portsmouth	29,215	9,686	119,902	8,565	8,582	1,918	287	3,426	3,003	62	378	297	537	0	185,859
Suffolk	8,198	2,196	7,370	53,302	3,887	4,097	118	3,118	2,468	69	460	273	551	14	86,121
Virginia Beach	54,471	94,066	9,844	5,882	839,265	2,709	22,566	6,582	7,391	206	1,493	910	1,550	0	1,046,937
Isle of Wight	1,520	988	1,222	3,348	1,611	72,684	52	4,637	3,732	85	532	339	681	42	91,474
Va Bch Waterfront	360	667	171	92	13,754	46	6,486	100	163	3	33	14	29	0	21,917
Newport News	2,438	3,234	2,042	2,448	3,874	4,374	122	487,205	93,645	1,963	10,480	6,141	34,322	1,063	653,352
Hampton	1,476	2,761	1,192	1,264	3,043	2,157	114	62,755	254,500	1,578	2,099	1,308	9,422	423	344,090
Poquoson	330	507	202	308	655	442	15	11,075	13,366	16,225	710	533	6,840	147	51,354
Williamsburg	32	33	18	26	69	34	3	783	229	9	17,878	3,660	3,311	26	26,111
James City	610	920	461	529	1,213	719	23	11,795	4,514	210	53,767	115,422	18,629	559	209,370
York	527	808	393	519	1,037	746	35	39,016	18,621	1,903	15,010	6,647	62,895	388	148,545
Gloucester	81	139	68	73	153	93	2	1,185	612	32	409	254	517	34,977	38,595
Total	427,317	501,316	212,768	97,154	1,065,684	96,683	32,397	646,322	417,489	22,724	105,533	137,409	142,082	37,639	3,942,517

Non Home-Based	Chesapeake	Norfolk	Portsmouth	Suffolk	Virginia Beach	Isle of Wight	Va Bch Waterfront	Newport News	Hampton	Poquoson	Williamsburg	James City	York	Gloucester	
	1	2	3	4	5	6	7	11	12	13	14	15	16	17	Total
Chesapeake	109,821	19,658	19,050	5,610	34,043	1,314	345	2,268	1,329	123	195	566	561	129	195,011
Norfolk	19,420	197,663	8,541	1,533	57,369	754	603	1,840	2,196	81	333	885	625	159	292,003
Portsmouth	19,152	8,681	53,388	4,222	5,484	842	94	1,084	744	30	143	357	260	61	94,541
Suffolk	5,822	1,618	4,294	22,093	2,087	2,165	43	1,307	877	39	102	375	258	71	41,151
Virginia Beach	33,632	57,210	5,363	1,964	362,732	1,497	8,346	3,686	2,190	215	231	798	964	226	479,055
Isle of Wight	1,423	836	901	2,247	1,662	32,120	61	2,609	1,754	67	106	453	396	98	44,733
Va Bch Waterfront	342	603	92	40	8,337	55	2,288	112	110	6	8	16	19	7	12,034
Newport News	2,479	2,043	1,183	1,364	4,071	2,562	118	175,643	37,393	1,790	2,276	5,985	16,032	610	253,549
Hampton	1,409	2,328	779	908	2,367	1,763	124	37,177	110,925	1,932	528	1,340	6,751	440	168,770
Poquoson	137	86	32	42	236	71	6	1,778	1,945	2,857	51	125	1,188	37	8,592
Williamsburg	223	376	160	110	262	110	9	2,371	560	55	14,347	11,359	4,731	99	34,772
James City	640	988	399	406	906	472	18	6,175	1,417	133	11,373	64,957	7,297	381	95,562
York	615	702	285	271	1,072	400	20	16,212	6,852	1,208	4,710	7,255	22,545	197	62,343
Gloucester	150	214	90	97	230	140	6	810	287	37	112	295	486	13,366	16,319
Total	195,266	293,005	94,555	40,907	480,856	44,264	12,080	253,072	168,578	8,573	34,515	94,766	62,115	15,881	1,798,434


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario -1
Change in Number
of Daily Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
JAMES CITY
WILLIAMSBURG
JAMES RIVER
YORK
POQUOSON
NEWPORT NEWS
HAMPTON
CHESAPEAKE BAY
Bridge-Tunnel
Chesapeake Bay
ISLE OF WIGHT
SUFFOLK
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
Internal to
Newport News,
HBW: +6,000
Internal to
Hampton,
HBW: +7,400
Internal to
Norfolk,
HBW: +6,100
Internal to
Isle of Wight,
HBW: + 2,100
Internal to
Chesapeake,
HBW: + 11,000
- 4,600
- 2,500
- 2,000
2,400
- 2,700
- 2,100
- 10,900
2,700
3,500
2,300
-2,300
8,400
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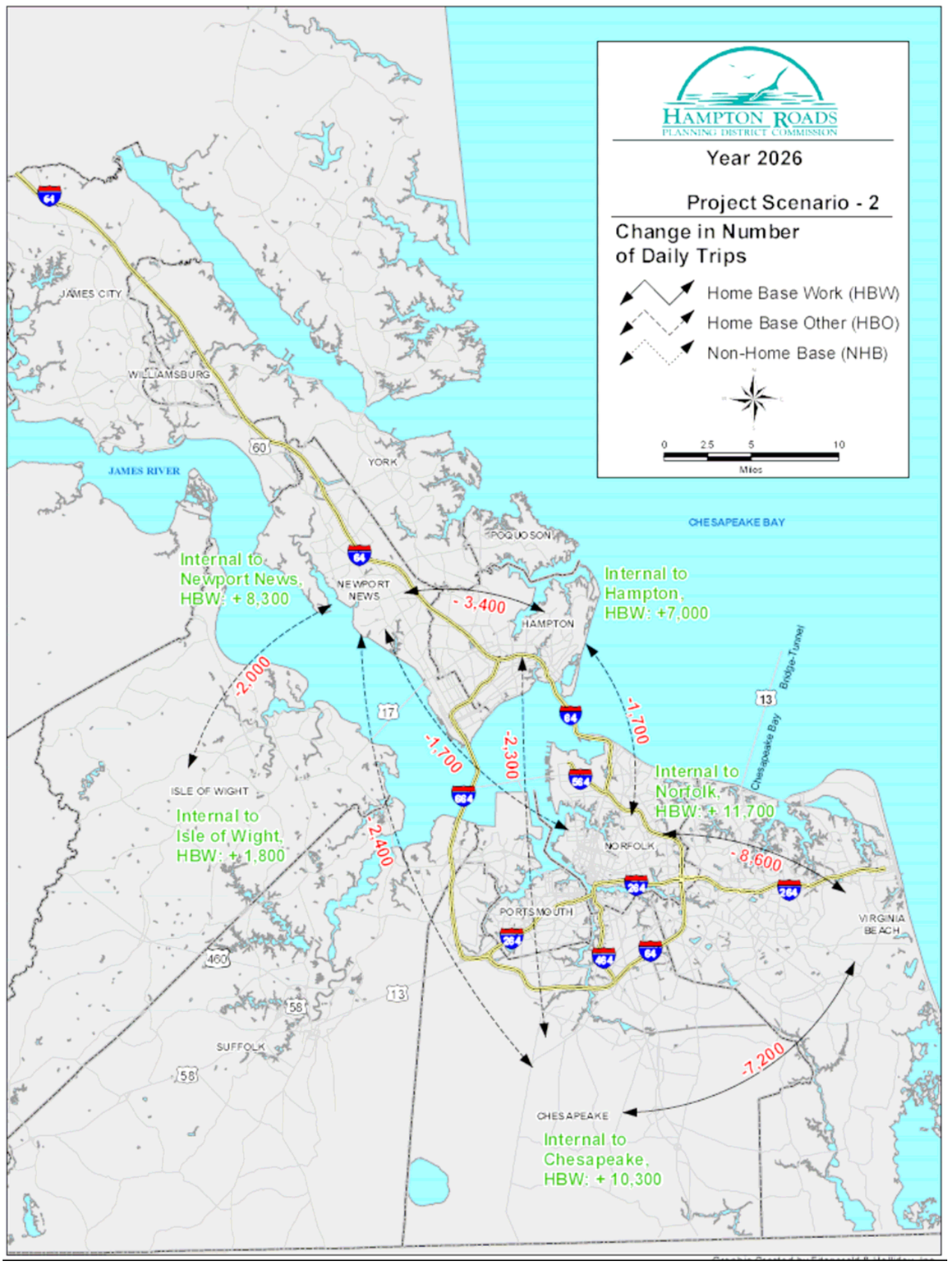
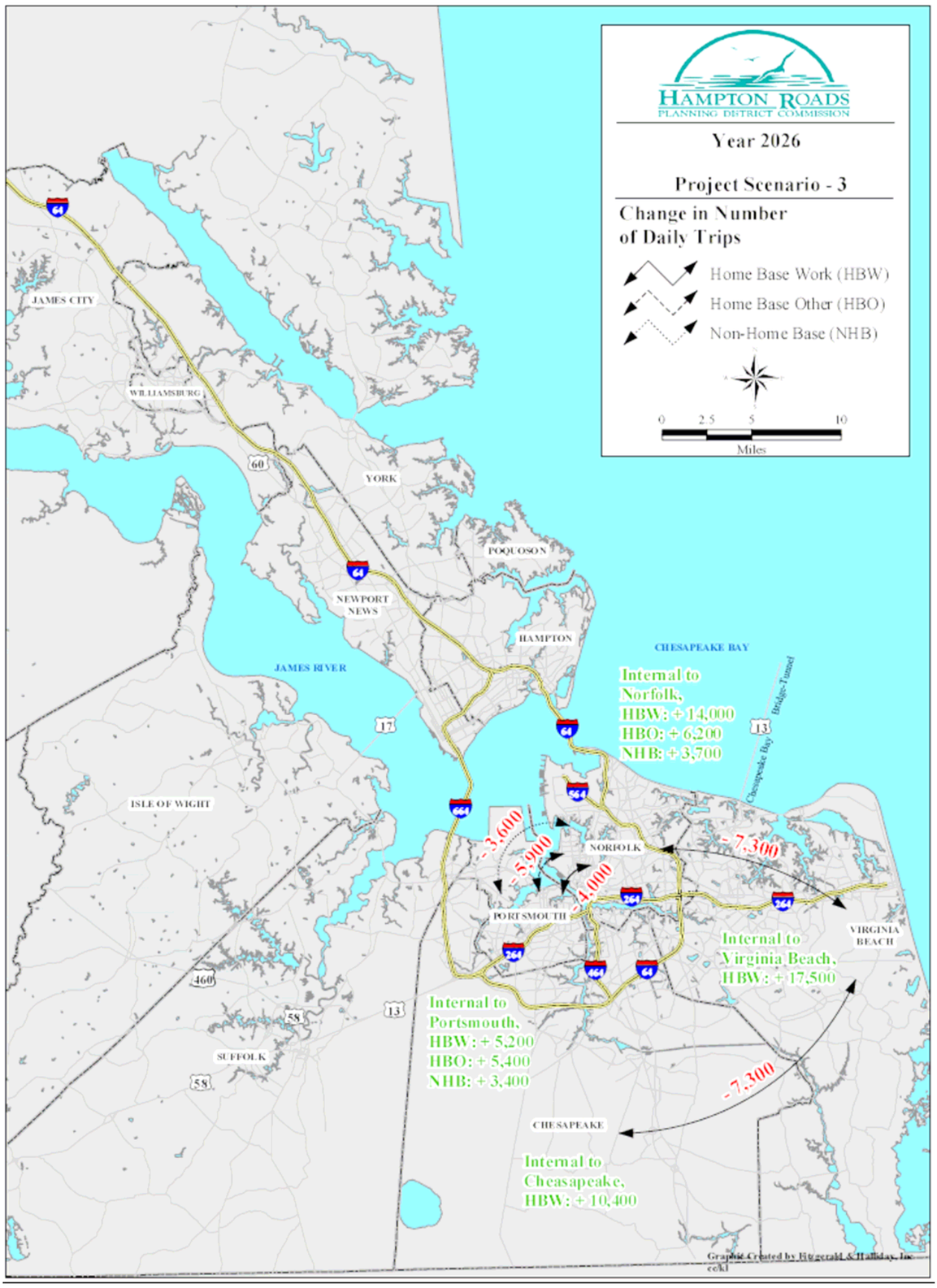

HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario - 2
Change in Number of Daily Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
JAMES CITY
WILLIAMSBURG
JAMES RIVER
YORK
POQUOSON
CHESAPEAKE BAY
NEWPORT NEWS
HAMPTON
Internal to Newport News, HBW: + 8,300
Internal to Hampton, HBW: +7,000
- 3,400
-2,000
-1,700
-2,300
-1,700
Chesapeake Bay Bridge-Tunnel
Internal to Norfolk, HBW: + 11,700
ISLE OF WIGHT
Internal to Isle of Wight, HBW: + 1,800
-2,400
NORFOLK
- 8,600
PORTSMOUTH
VIRGINIA BEACH
SUFFOLK
-7,200
CHESAPEAKE
Internal to Chesapeake, HBW: + 10,300


HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Project Scenario - 3
Change in Number
of Daily Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Chesapeake Bay Bridge-Tunnel
ISLE OF WIGHT
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
SUFFOLK
CHESAPEAKE
Internal to
Norfolk,
HBW: + 14,000
HBO: + 6,200
NHB: + 3,700
- 3,600
- 5,900
- 4,000
- 7,300
Internal to
Virginia Beach,
HBW: + 17,500
Internal to
Portsmouth,
HBW: + 5,200
HBO: + 5,400
NHB: + 3,400
- 7,300
Internal to
Cheasapeake,
HBW: + 10,400
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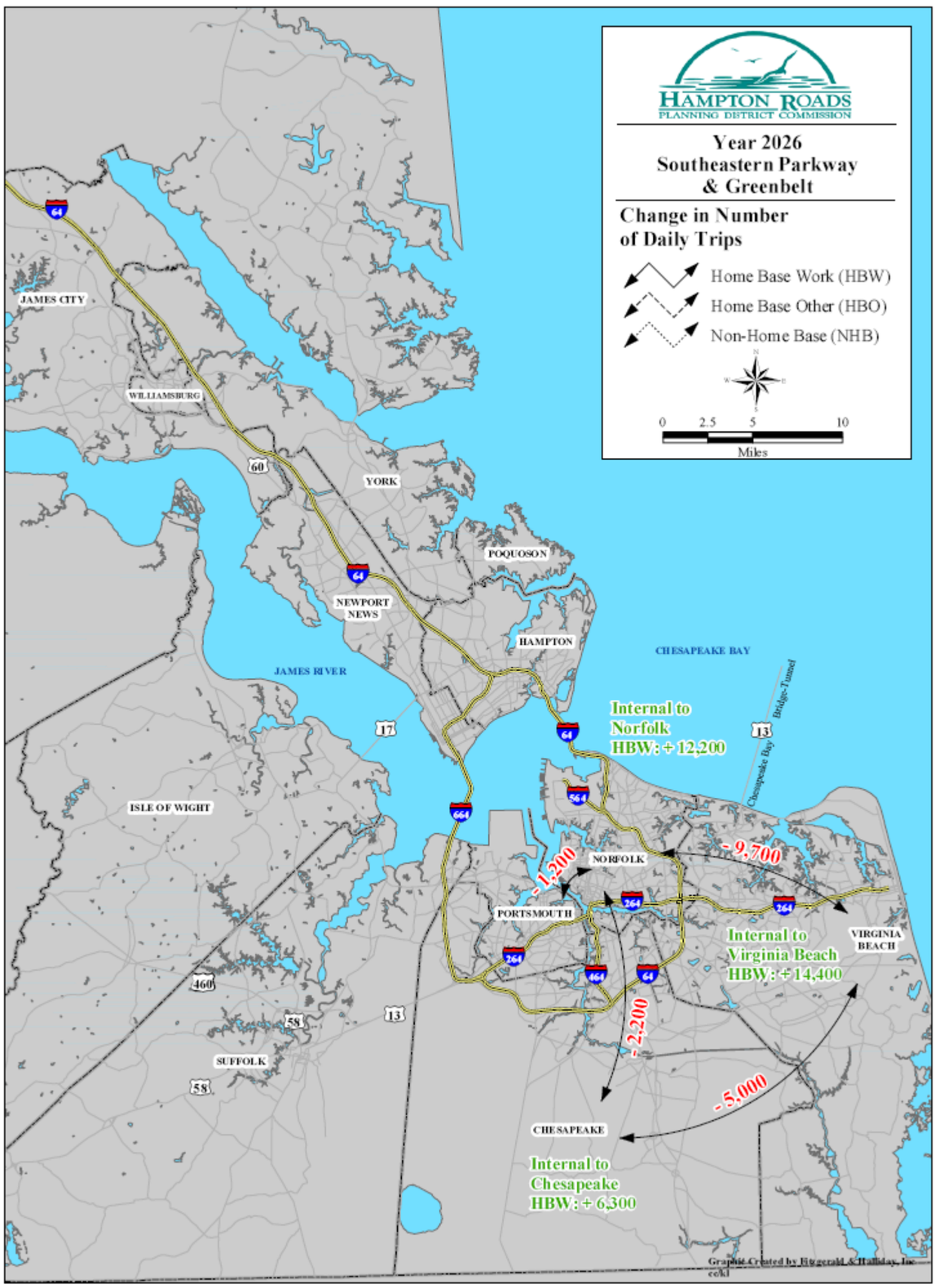
HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Southeastern Parkway
& Greenbelt
Change in Number
of Daily Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT NEWS
HAMPTON
JAMES RIVER
CHESAPEAKE BAY
Bridge-Tunnel
Chesapeake Bay
ISLE OF WIGHT
SUFFOLK
NORFOLK
PORTSMOUTH
VIRGINIA BEACH
CHESAPEAKE
Internal to
Norfolk
HBW: + 12,200
- 1,200
- 9,700
Internal to
Virginia Beach
HBW: + 14,400
- 2,200
- 5,000
Internal to
Chesapeake
HBW: + 6,300
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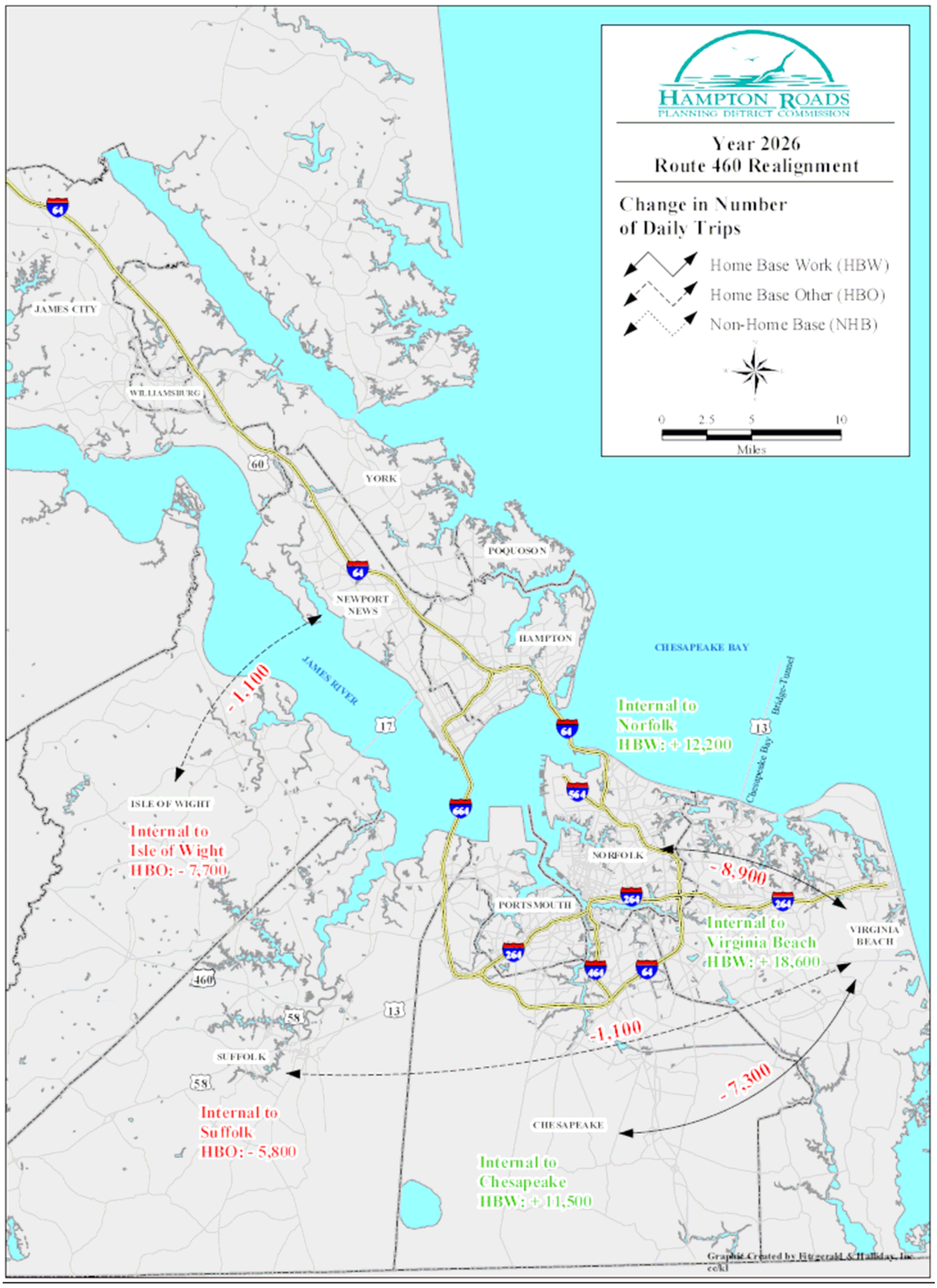
HAMPTON ROADS
PLANNING DISTRICT COMMISSION
Year 2026
Route 460 Realignment
Change in Number
of Daily Trips
Home Base Work (HBW)
Home Base Other (HBO)
Non-Home Base (NHB)
0 2.5 5 10
Miles
JAMES CITY
WILLIAMSBURG
YORK
POQUOSON
NEWPORT NEWS
HAMPTON
CHESAPEAKE BAY
JAMES RIVER
Chesapeake Bay Bridge-Tunnel
- 1,100
Internal to
Norfolk
HBW: + 12,200
ISLE OF WIGHT
Internal to
Isle of Wight
HBO: - 7,700
NORFOLK
- 8,900
PORTSMOUTH
Internal to
Virginia Beach
HBW: + 18,600
VIRGINIA BEACH
-1,100
- 7,300
SUFFOLK
Internal to
Suffolk
HBO: - 5,800
CHESAPEAKE
Internal to
Chesapeake
HBW: + 11,500
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